

ESTIMATING

Introduction

In accordance with the requirements of the State Contract Act, the State Highway Engineer must prepare full, complete, and accurate plans, specifications and estimates of cost before entering into any contract. The estimate, known as the “Engineers Estimate”, lists the total quantity and estimated price for each item, and is used as a basis for requesting authority to advertise a project. After bids are received, the Engineer’s Estimate is used as a basis for determining if the bid estimates are reasonable.

The Bridge Cost Estimates Branch provides the item costs for the Engineers Estimate for all bridge and highway related structures. This cost estimate data, along with the special provisions and contract plans, make up the Structure’s portion of the PS&E package.

General

BEES (Basic Engineering Estimate System)

The bridge portion of the Engineers Estimate is entered into Basic Engineering Estimate System or BEES by SOE, Bridge Cost Estimates Branch. BEES is a computer program used for storing estimated quantities and prices for each item of the project. The bridge portion of the estimate is placed in the B (bridge) file and the Districts enter their portion of the estimate in the H (highway) file. The BEES computer program then generates the C (combined) estimate for the entire project.

BEES has the capability of segregating estimates by structure, alternative designs, etc. BEES segregation is performed by the District. BEES is a sub-system of the Project Information System and Analysis (PISA) and utilizes the information contained in the Project Management Control System (PMCS) and the Standardized Item List. The estimate data is available for bid opening purposes and for contract progress payments.

Revised Estimates

When any changes such as quantity, cost, or scope of work are made it is the responsibility of the Design Branch Leader and Project Engineer to advise all interested parties as successive estimates are made during the development of a project.

Quantity Calculations

Quantity calculations are to be submitted to the Bridge Cost Estimates Branch along with the Estimate Summary sheets. Calculations for Marginal “Blue Sheet” Estimates are retained in Cost Estimates Branch until the contract is awarded, at which time they are forwarded to the Resident Engineer’s Pending File for the Structure Representative’s use during the course of construction.

Escalation Factor

Structure estimates are prepared on the basis of prices which are valid on the day the estimate is made. As part of their procedure in developing their planning program, the Districts periodically apply an escalation factor according to the cost index to these estimates as necessary to cover inflation.

Mobilization Factor

Structure estimates generally include an item for mobilization. The value of this item is estimated at 10% of the total cost of bid items. If a particular kind or size of a project does not require a separate item for mobilization, the unit price for one or more of the major items of work will be inflated to cover the contractors cost for mobilization.

Contingency Factors

A contingency factor is added to all estimates to cover the costs of unforeseen design changes and the uncertainty of early quantity estimates. Contingency factors are shown below:

Planning Estimates	25%	Contingency
General Plan Estimates	20%	Contingency
Marginal Estimate – Final PS&E	5%	Contingency

Stage Construction

It is sometimes necessary to build a bridge in stages. The most common case is replacing a bridge on existing alignment. This will increase the cost about 25% and the construction time about 75%. The plans must show the width of each stage and indicate how traffic is to be handled during each stage of construction.

Traffic Control

This item of work is defined and estimated by the Districts. However, it is important that the bridge designer understands how traffic will affect the work and relay this information to Cost Estimates either verbally or by notes on the plans or estimate. At the Plans and Quantities (P&Q) stage of project delivery, all traffic considerations shall be included in the memo to specifications engineer/estimator. Usual situations are “Work 9 AM – 3 PM only” or “All work at night or on weekends.” This and other items concerning work in traffic should be discussed with the District Project Engineer at an early stage. More expensive types of work that can be done quickly without traffic control may be justified by the savings in traffic control costs. Design shall submit lane closure charts when available to cost estimates.

Working Days

The Cost Estimates Branch determines the number of working days necessary to construct the bridge portion of the contract work for PS&E. Design shall submit information regarding restrictions and constraints to cost estimates. At the District’s request, working days will be provided for Advanced Planning and General Plan stages.

Historical Cost Record

This form is to be used by the Project Engineer to maintain a cost record for all structures in the design phase. It is designed for multi-structure projects, but can also be used for individual structures. The Project Engineer is usually the only one familiar with the reason for revisions and related cost changes. Explain these on the back of the form. A copy of the Historical Cost Record form (DS-D-0001) available on the Cost Estimates Branch website:

<http://www.dot.ca.gov/hq/esc/estimates/>

Design Branch Leaders are responsible for assuring that the cost record and the Status agree. Cost changes that are a result of price changes made by Cost Estimates are also to be recorded.

Planning Estimates (Advance Planning Studies)

These preliminary estimates are usually based on District geometrics and are used to determine the overall project cost for budgeting purposes. Design prepares a drawing of the structure, called an “Advanced Planning Study”, which shows all significant details that would affect the cost (See Memo to Designers 1-8). Design shall then submit a completed advance planning study and general plan estimate checklist for each planning estimate.

For usual or normal types of new bridge structures, the Cost Estimates Branch will determine the quantities using their file of square meter factors.

For unusual structures such as retaining walls, seismic retrofits, barrier replacements, sliver widenings of less than five meters in width, deck rehabilitations, or in cases where a close comparison of costs of several different types of structures are required, the designer computes preliminary quantities using any of the aids found in this chapter and submits them along with a completed Bridge Planning Estimate form (DS - D - 0016) and Structure plan sheet to the Cost Estimate.

Current Planning Estimate forms may be downloaded from the Cost Estimates Branch website:

<http://www.dot.ca.gov/hq/esc/estimates/>

General Plan Estimates

The District develops the precise alignment and submits the bridge site data to Preliminary Investigations. The bridge site data is incorporated into the Preliminary Report which is ultimately forwarded to Bridge Design. Bridge Design chooses the most feasible and usually the most economical type of structure to fit the conditions described in the Preliminary Report and then develops a General Plan. The structure depicted in the General Plan may be different from the structure used for the Planning Estimate.

From the General Plan an estimate of cost is determined by the Cost Estimates Branch from quantities calculated by Bridge Design.

The preparation of quantities for General Plan Estimates requires a rapid but close approximation of the final quantities for the job. All items which are a part of the cost of the bridge should be included in the estimate.

In preparing the quantities, the quantity estimator utilizes the graphs and tables prepared for this purpose, similar jobs, or computations based on dimensions from the preliminary design.

Current General Plan Estimate forms may be downloaded from the Cost Estimates Branch website:

<http://www.dot.ca.gov/hq/esc/estimates/>

Bar Reinforcement /m³ of Concrete for Various Bridge Parts

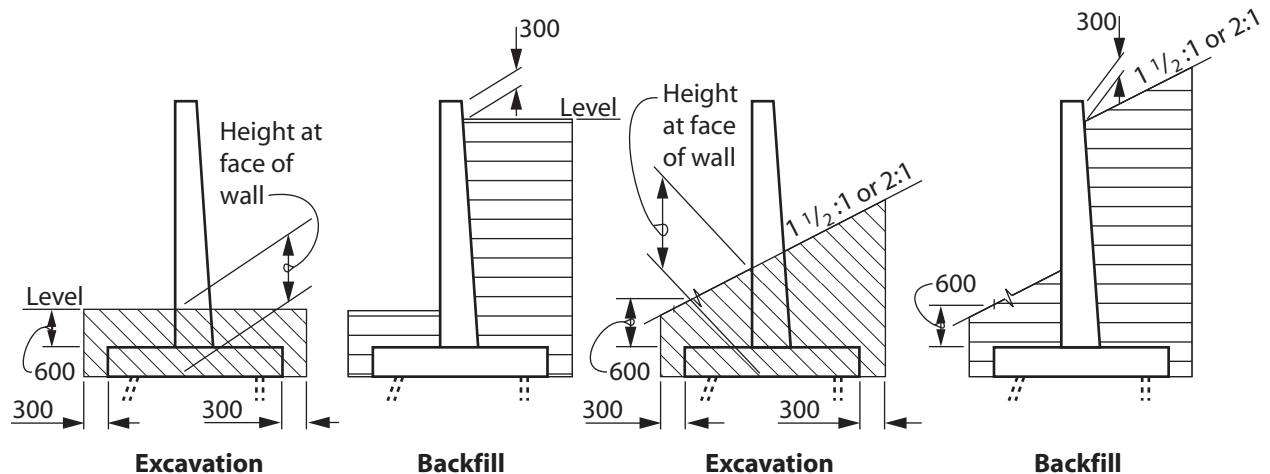
The following are approximate quantities of Bar Reinforcement per cubic meter of concrete.
Use for Planning and General Plan Estimates only.

Deck slab on prestressed or steel girders	134 kg/m ³
Bent Caps	90 kg/m ³
Single column bents	268 kg/m ³ (170-324 variation)
Multiple column bents	134 kg/m ³ (57-208 variation)
Piers and walls of simulated closed end abutments	48 kg/m ³
Footings	90-119 kg/m ³
End diaphragm abutments	48 kg/m ³
Cantilever and strutted abutments	Design Charts
Retaining walls	Page 11- 49
Seat Type Abutments Skews < 15°	54 kg/m ³
Skews 15° to 45°	60 - 83 kg/m ³
Bar Reinforcement/m ² of Deck Area	
Cast-In-Place Reinforced Slab	64 kg/m ²

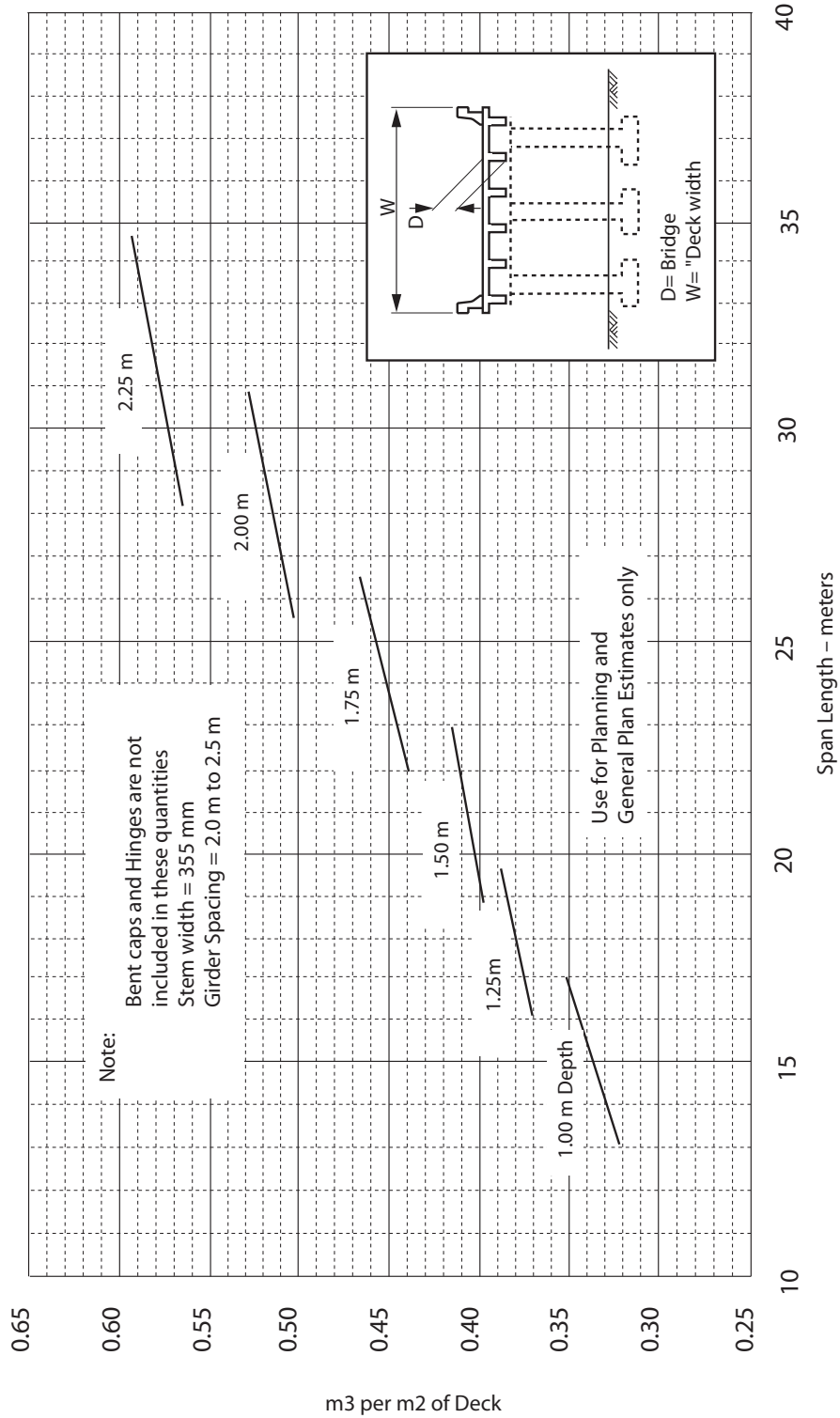
Note: See “Sources of Quantities for Standard Details” shown in SECTION 11.

Type 1 Retaining Wall Excavation and Backfill Quantities
Per linear meter in m³
Use for Planning and General Plan Estimates only

H	Level			1 1/2 : 1			2 : 1		
	Height at Face	Excav	Backfill	Height at Face	Excav	Backfill	Height at Face	Excav	Backfill
mm	mm	m ³ /m	m ³ /m	mm	m ³ /m	m ³ /m	mm	m ³ /m	m ³ /m
1200	1000	1.60	0.84	1500	2.43	1.17	1200	2.05	1.09
1800	1000	1.90	1.56	1500	2.98	2.04	1200	2.50	1.92
2400	1000	2.20	2.51	1500	3.55	3.16	1300	3.11	3.00
3000	1000	2.50	3.68	1600	4.31	4.53	1400	3.78	4.32
3600	1000	2.80	4.98	1700	5.14	6.06	1500	4.51	5.79
4200	1100	3.30	6.34	1800	5.93	7.61	1600	5.23	7.29
4800	1100	3.63	8.15	1900	6.89	9.69	1700	6.07	9.31
5500	1200	4.19	10.37	2000	7.91	12.21	1800	6.98	11.75
6100	1200	4.53	12.65	2100	8.99	14.82	1900	7.94	14.28
6700	1300	5.29	15.36	2200	10.42	17.97	2000	9.21	17.32
7300	1400	6.10	17.73	2300	11.80	20.73	2100	10.45	19.98
7900	1500	6.99	20.05	2400	13.28	23.46	2200	11.79	22.61
8500	1600	7.94	22.84	2500	14.85	26.69	2300	13.21	25.73
9100	1700	9.20	26.60	2600	17.27	31.29	2400	15.34	30.12
9700	1800	10.74	30.43	2700	20.03	36.03	2500	17.81	34.63
10300	1900	11.91	33.77	2900	22.37	39.93	2600	19.54	38.39
10900	2000	13.14	37.28	3000	24.39	44.03	2700	21.35	42.34

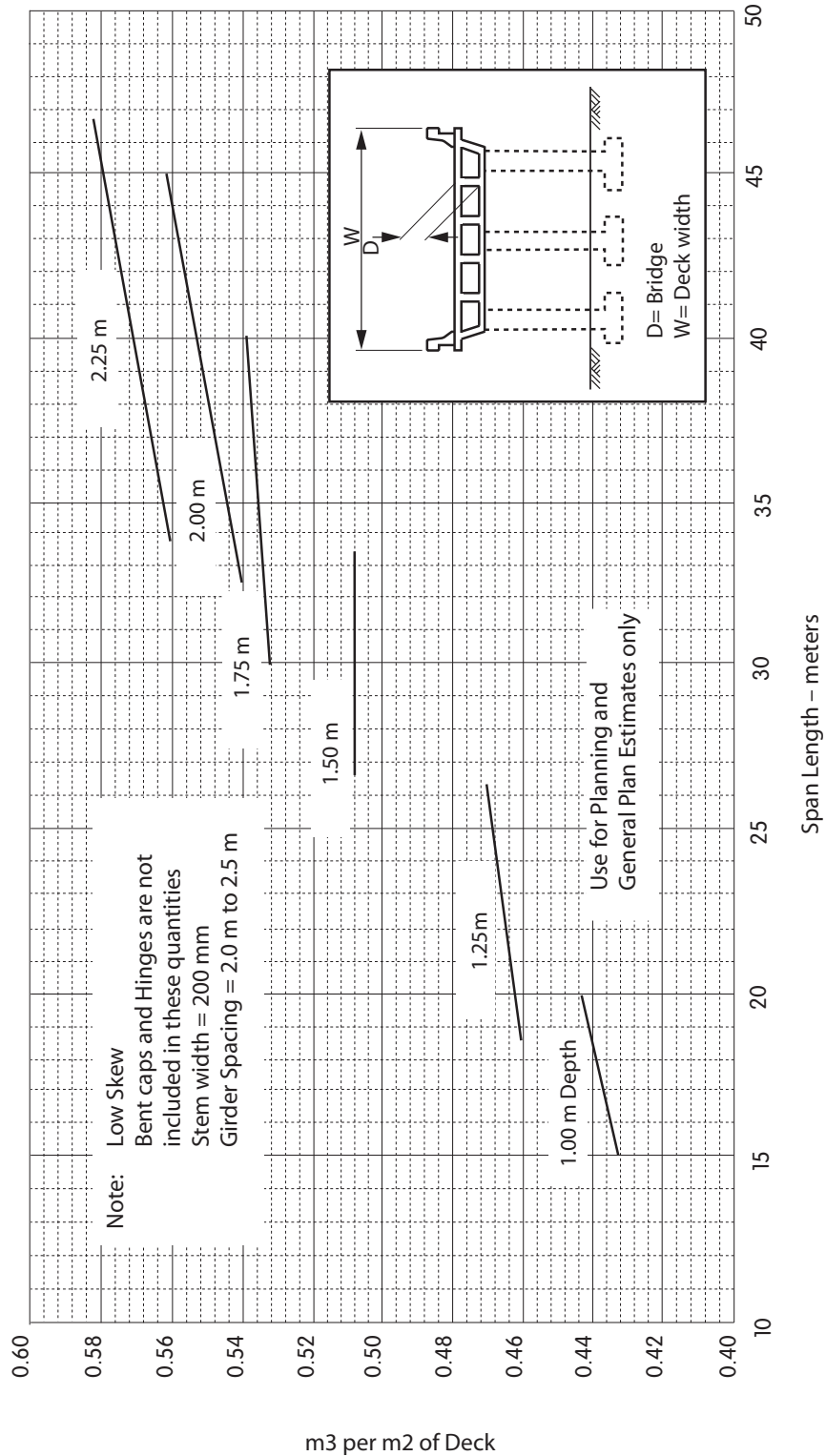


Preliminary Quantity Survey
Girders, Deck and Diaphragms Only
(Calculate cap quantity separately)

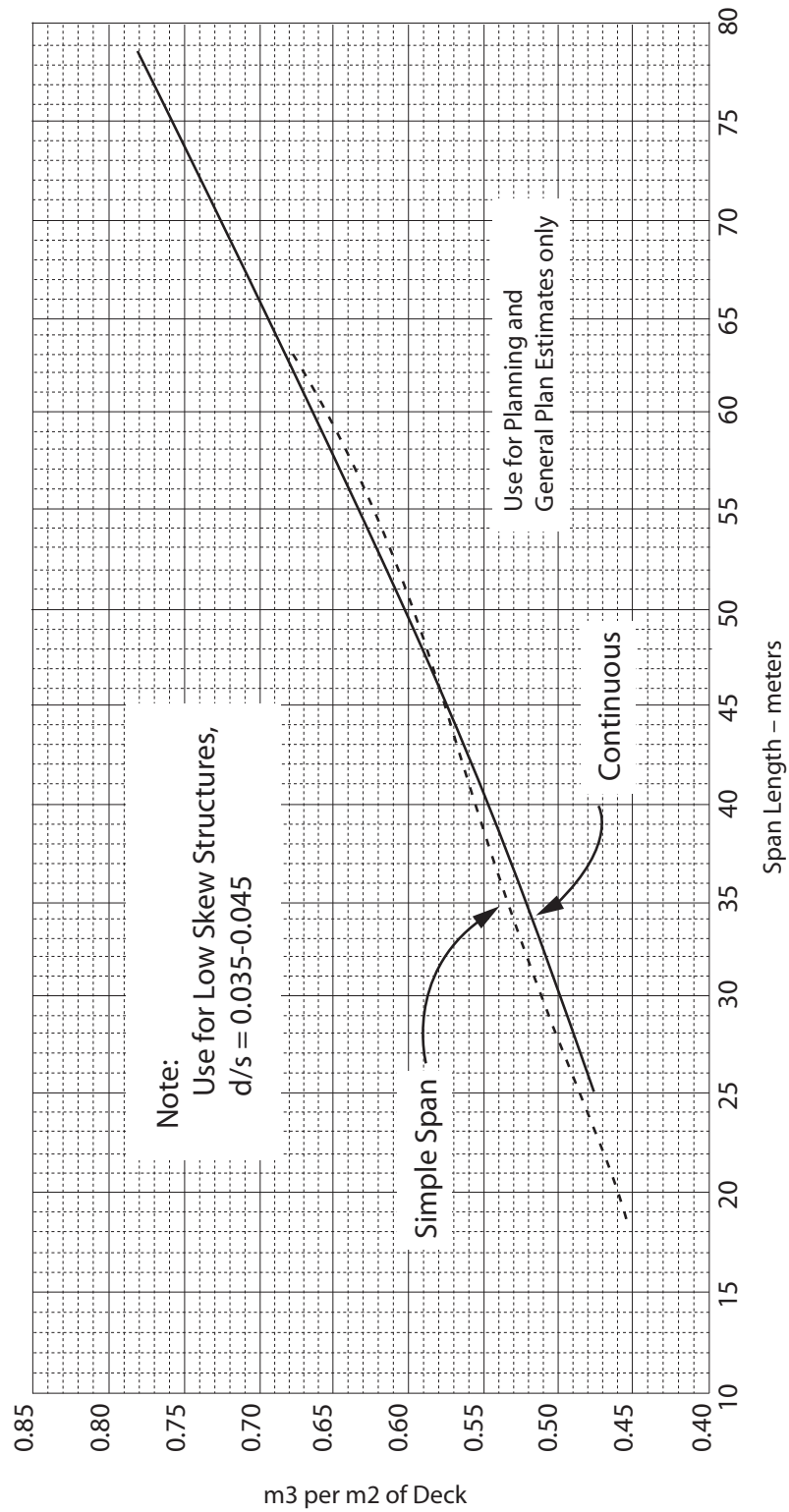


Continuous Tee-Beam Superstructure Concrete

Preliminary Quantity Survey
Girders, Deck and Diaphragms Only
(Calculate cap quantity separately)

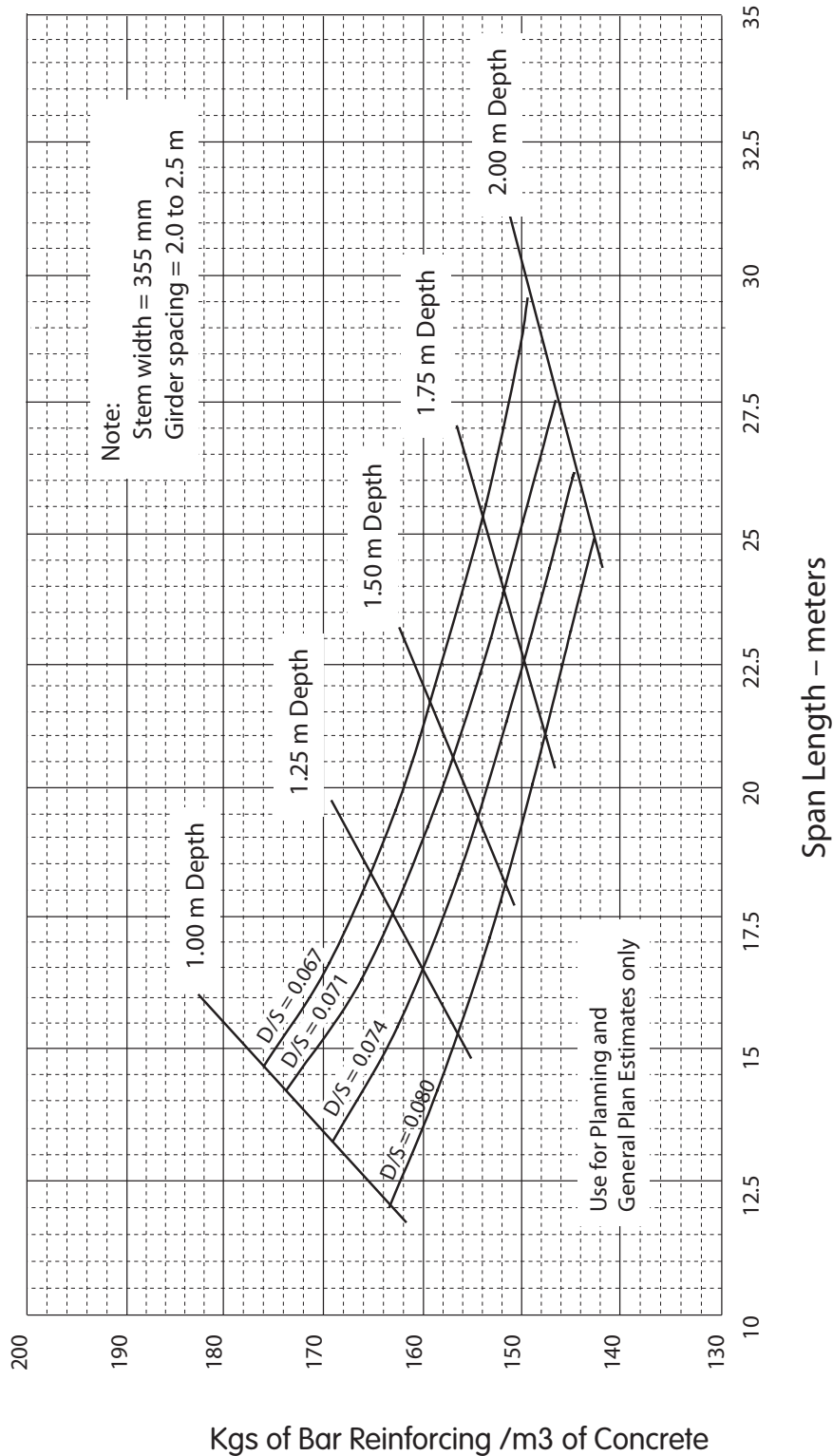


Continuous Reinforced Box Girder Superstructure Concrete

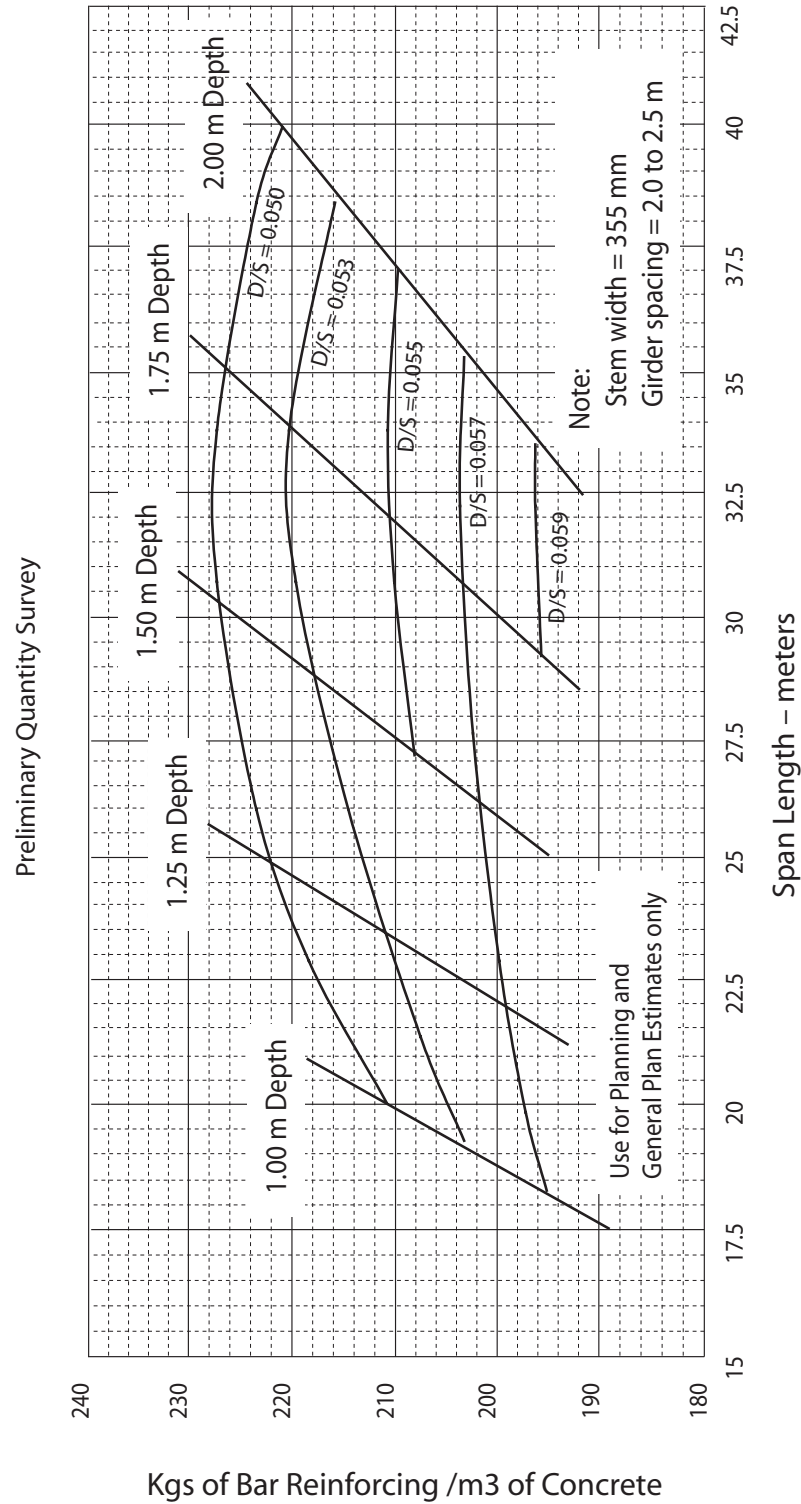


CIP / PS Box Girder Superstructure Concrete

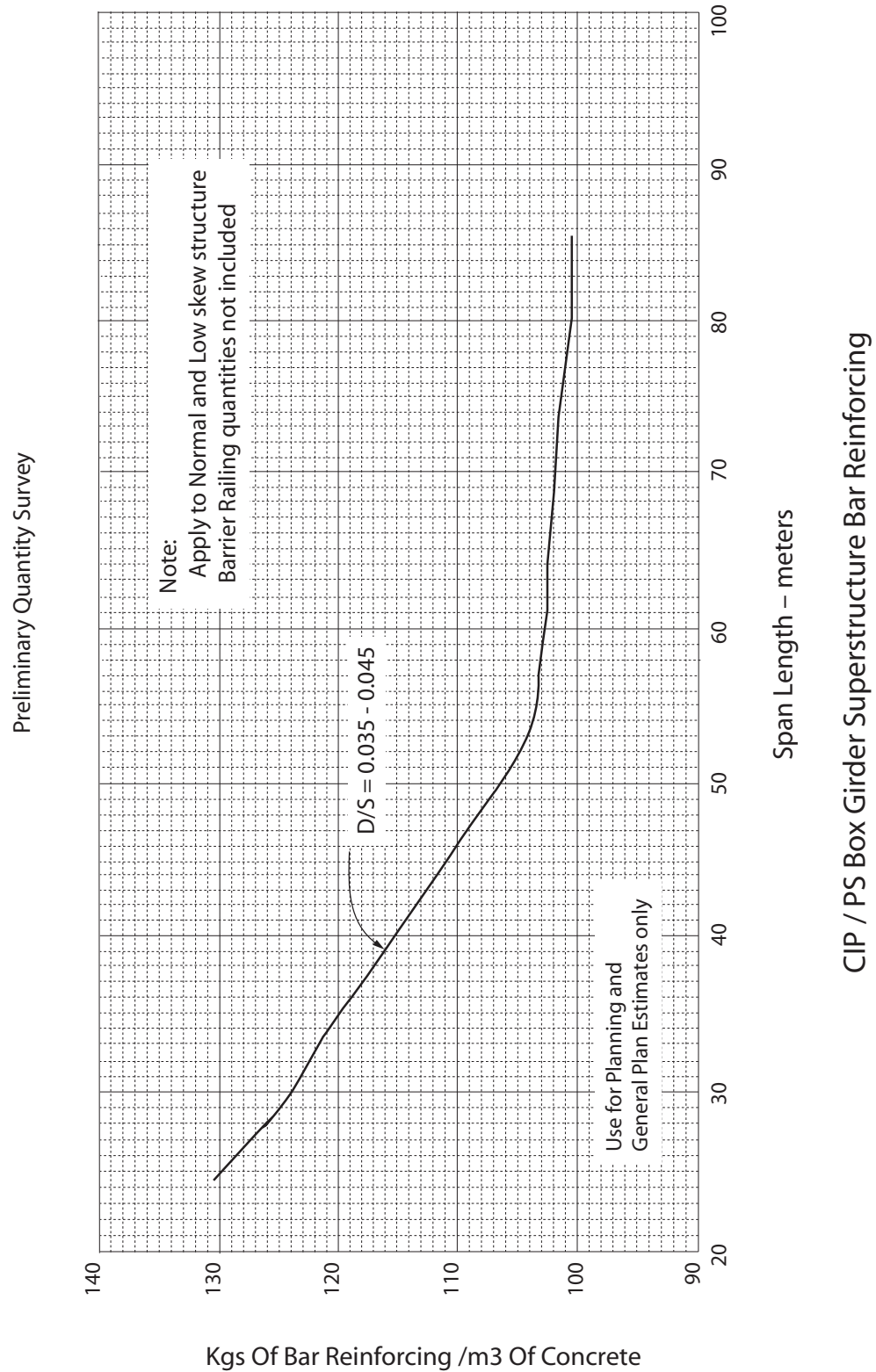
Preliminary Quantity Survey
Girders Deck and Diaphragms Only
(Calculate cap quantity separately)



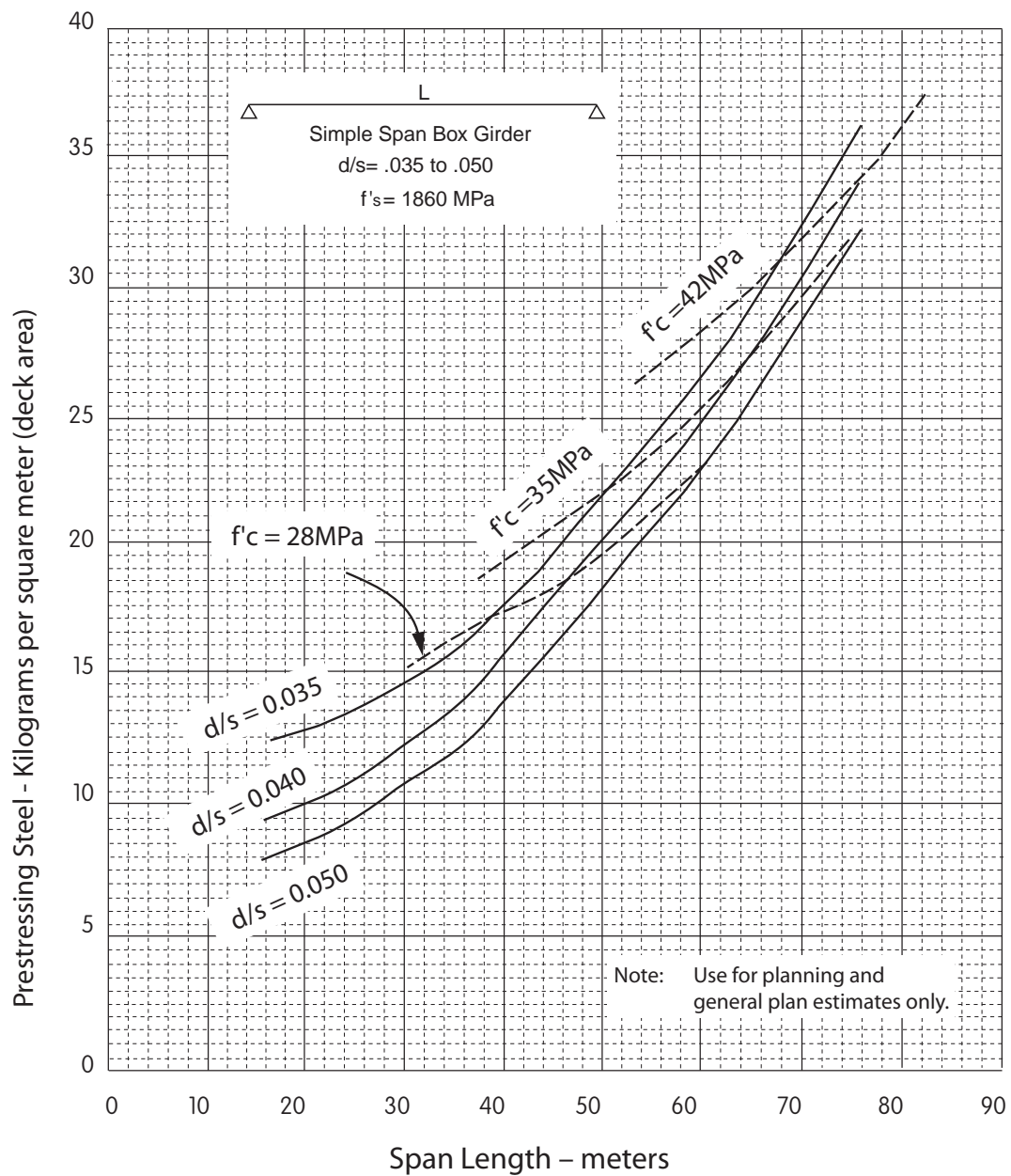
Tee Beam Superstructure Bar Reinforcing



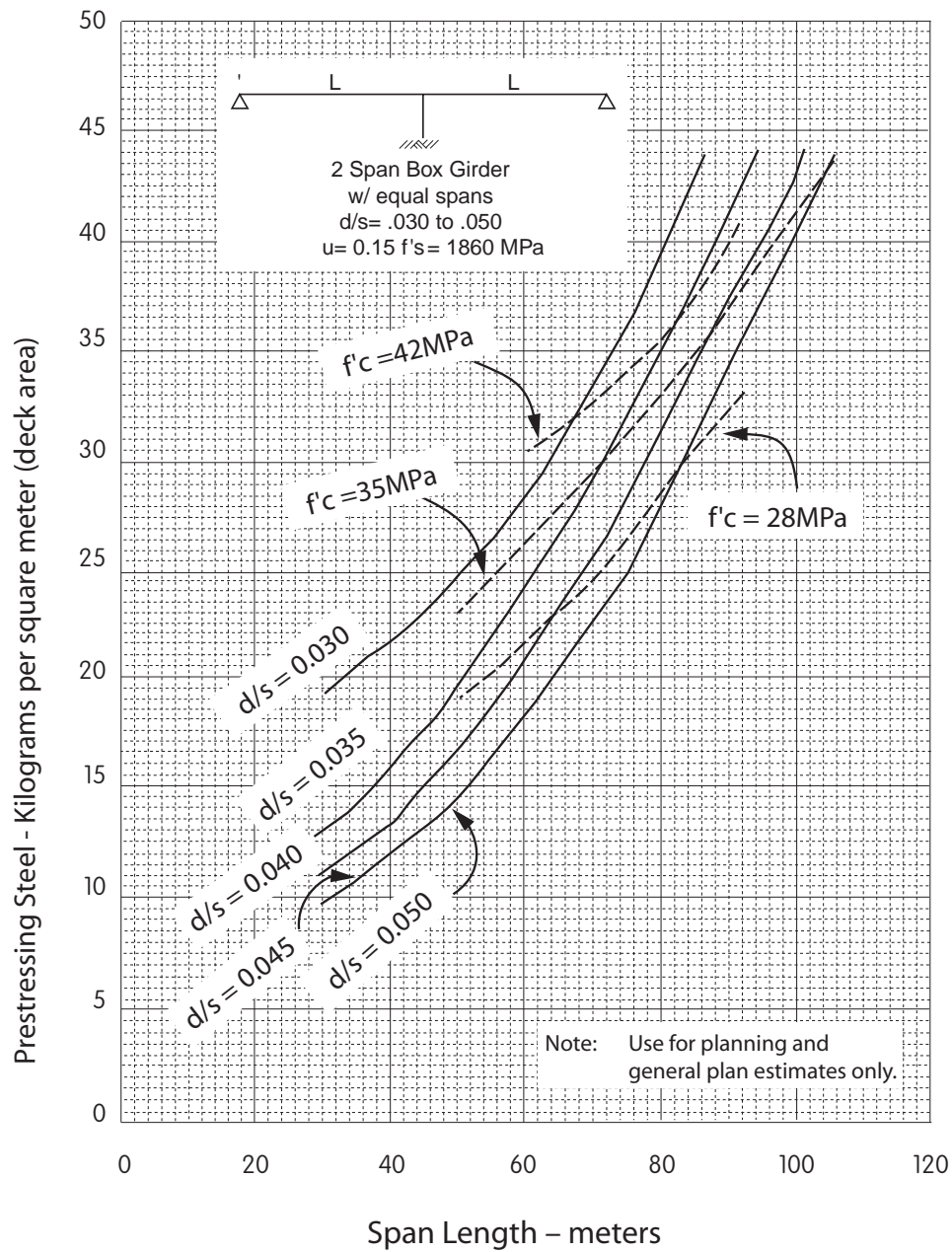
Conventionally Reinforced Box Girder Superstructure Bar Reinforcing



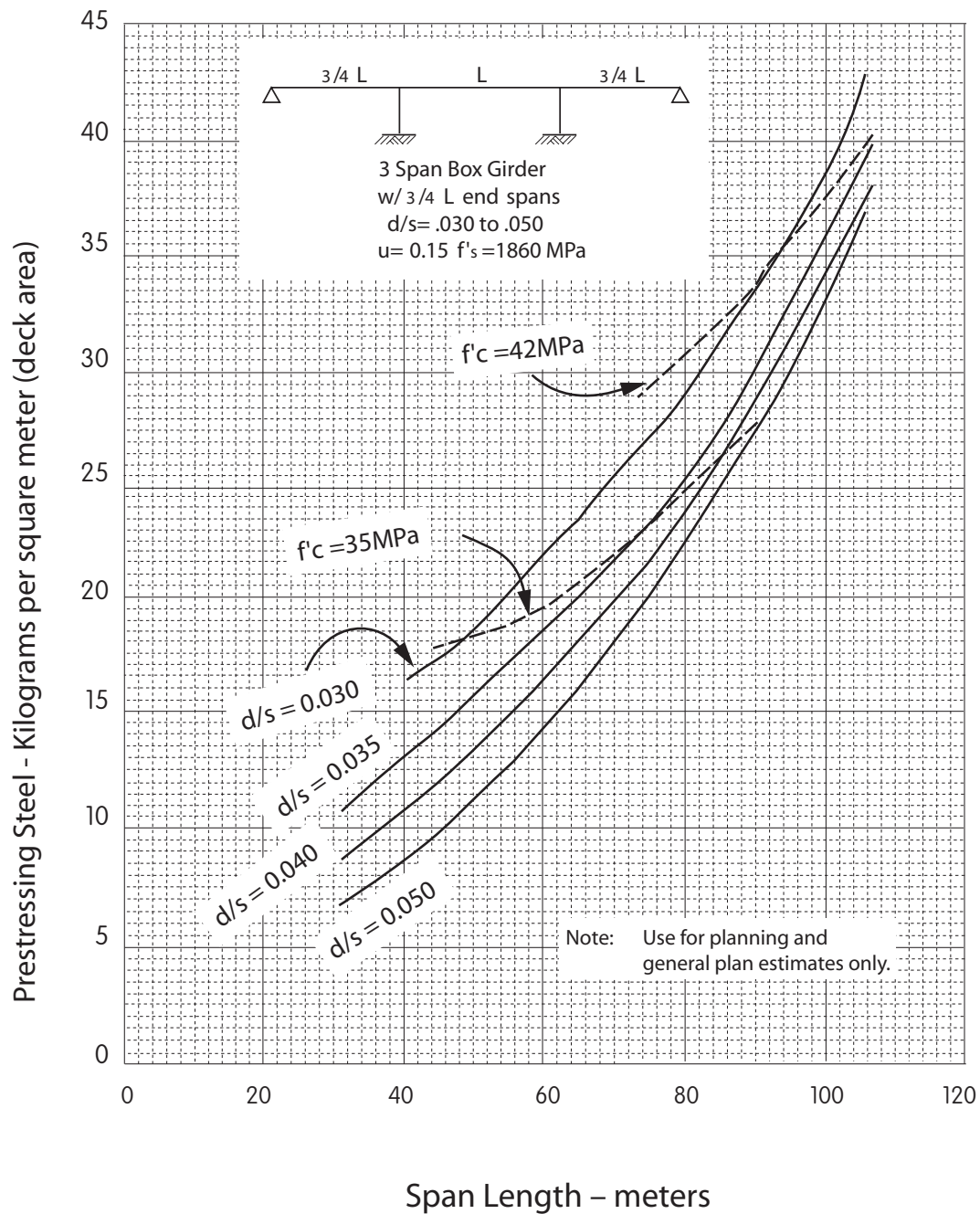
CIP Prestressed Box Girder Prestressing Steel



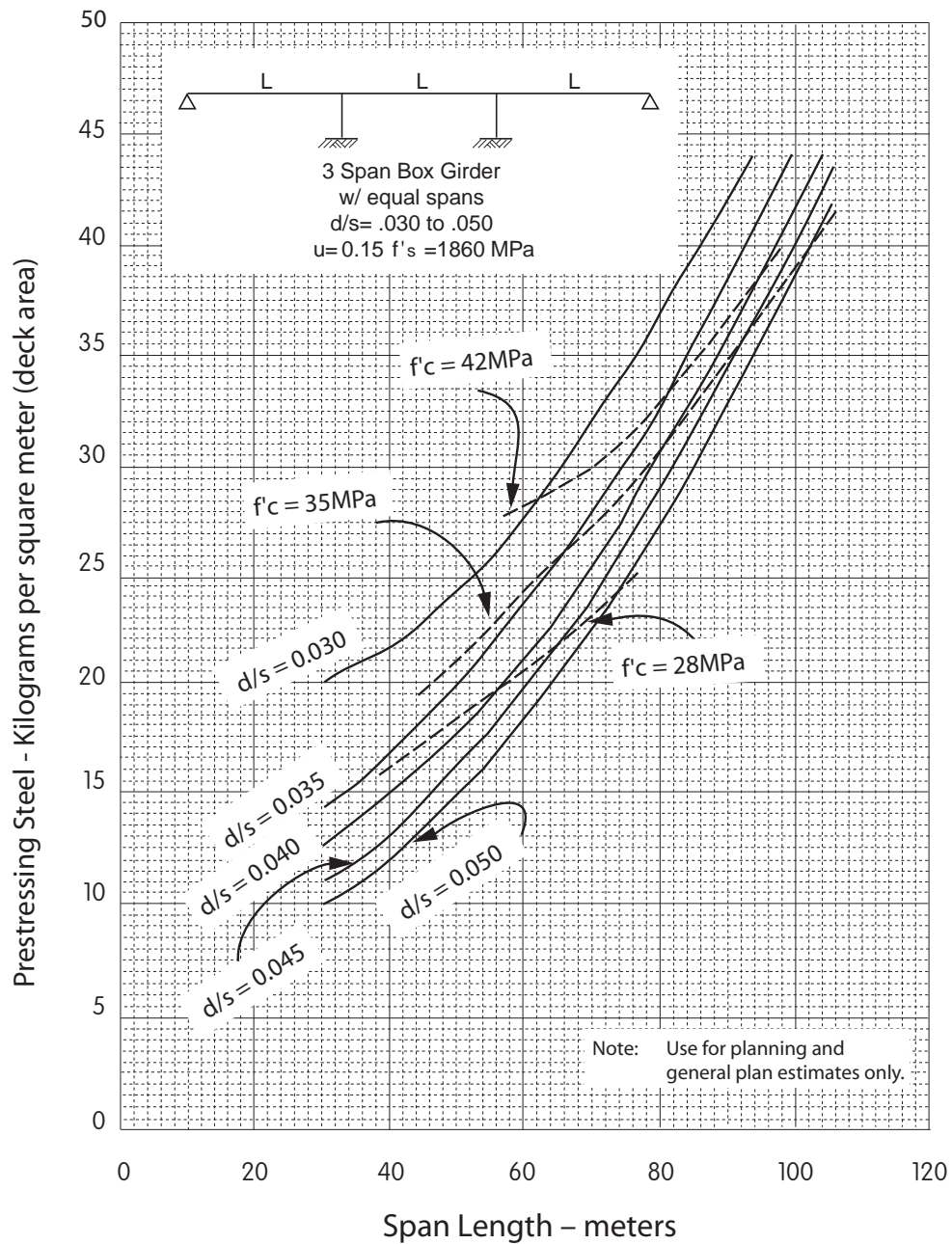
CIP Prestressed Box Girder Prestressing Steel



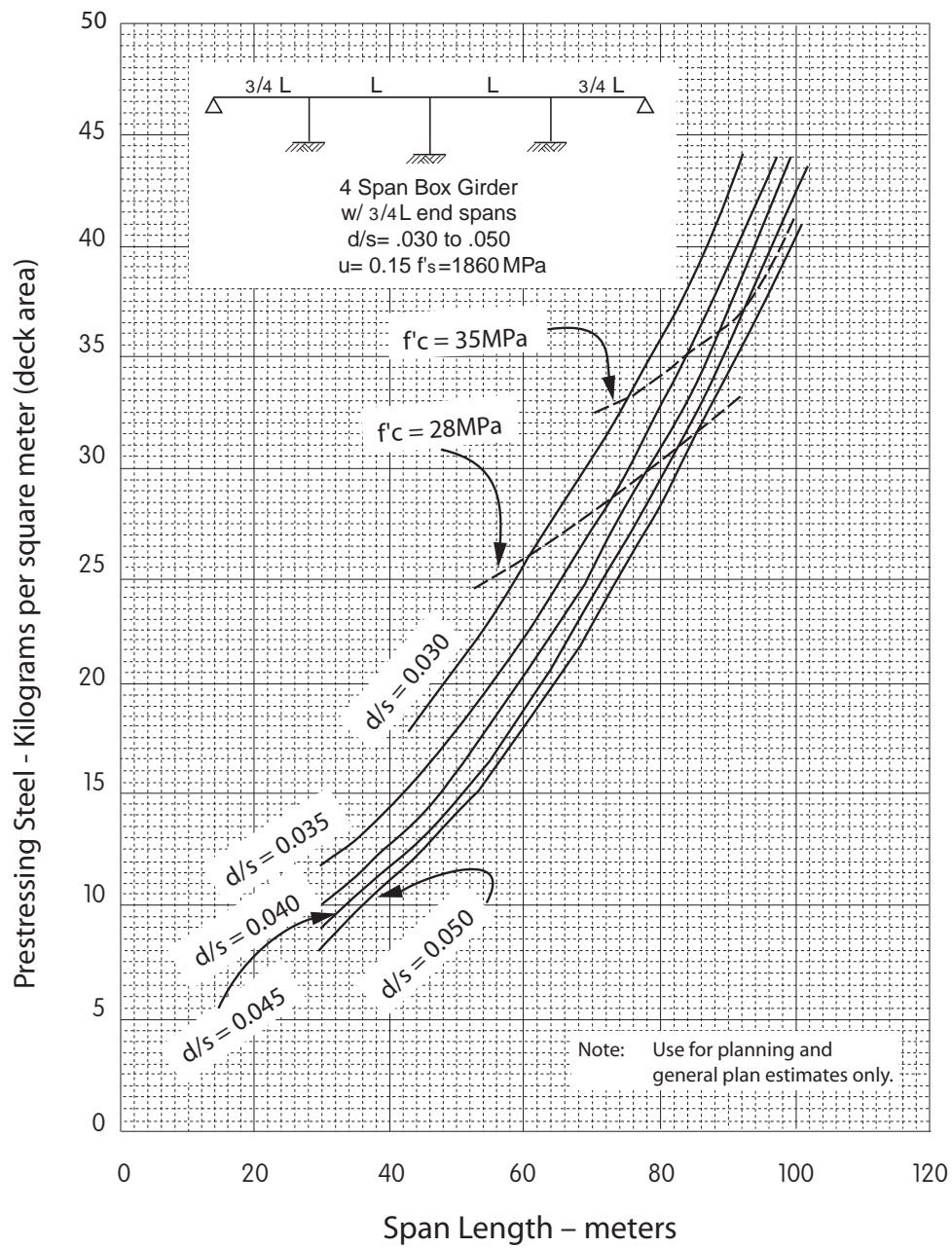
CIP Prestressed Box Girder Prestressing Steel



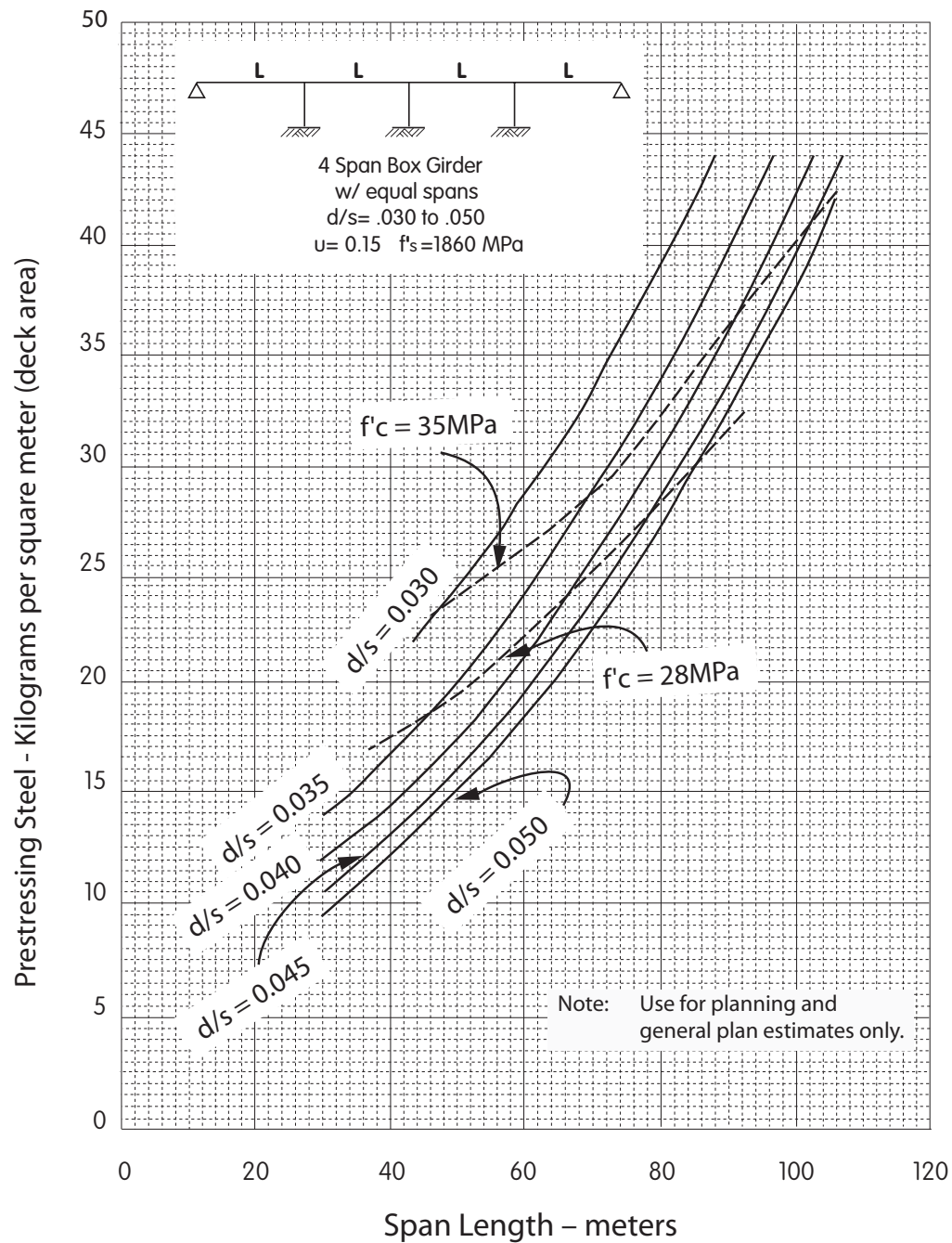
CIP Prestressed Box Girder Prestressing Steel



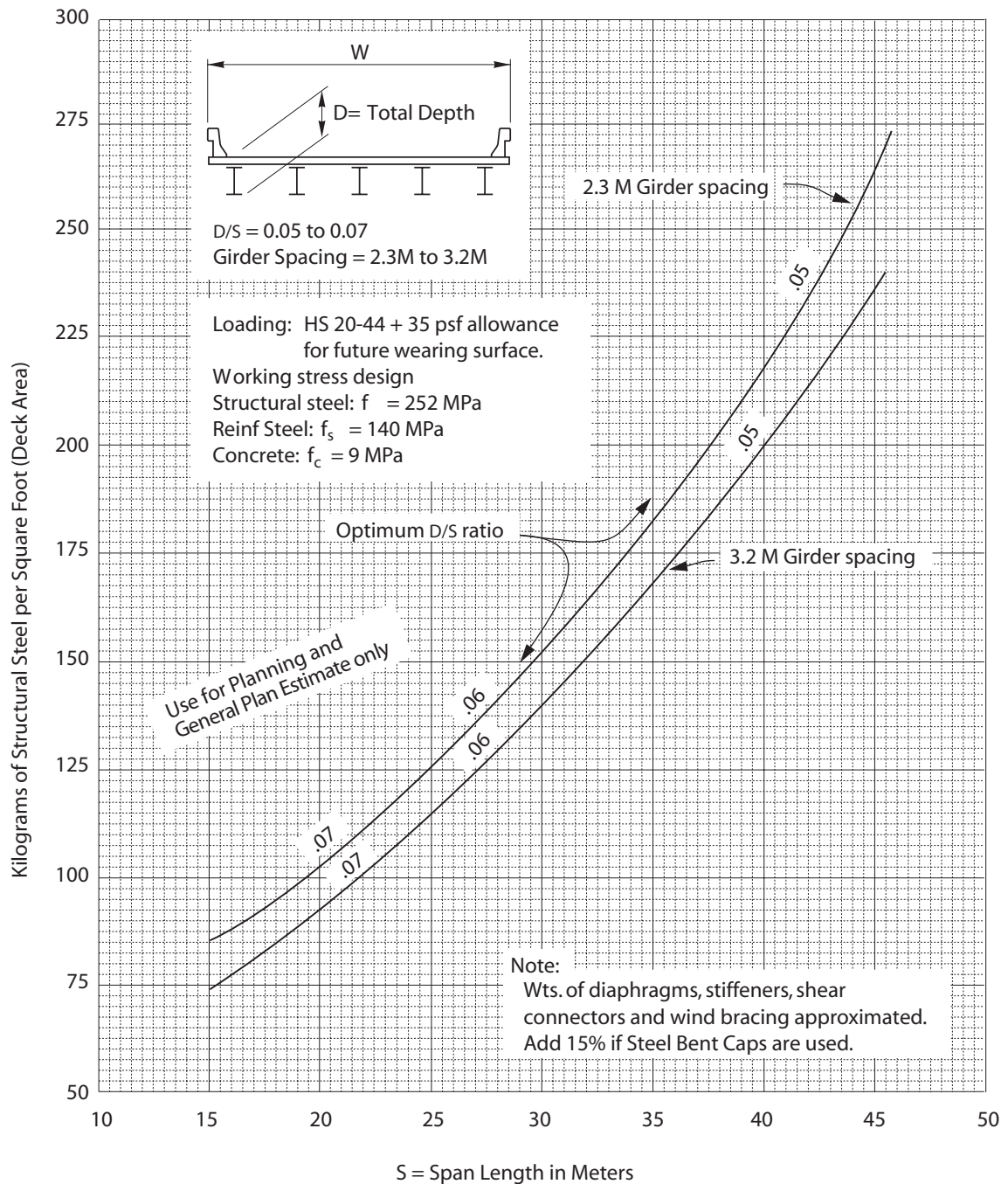
CIP Prestressed Box Girder Prestressing Steel

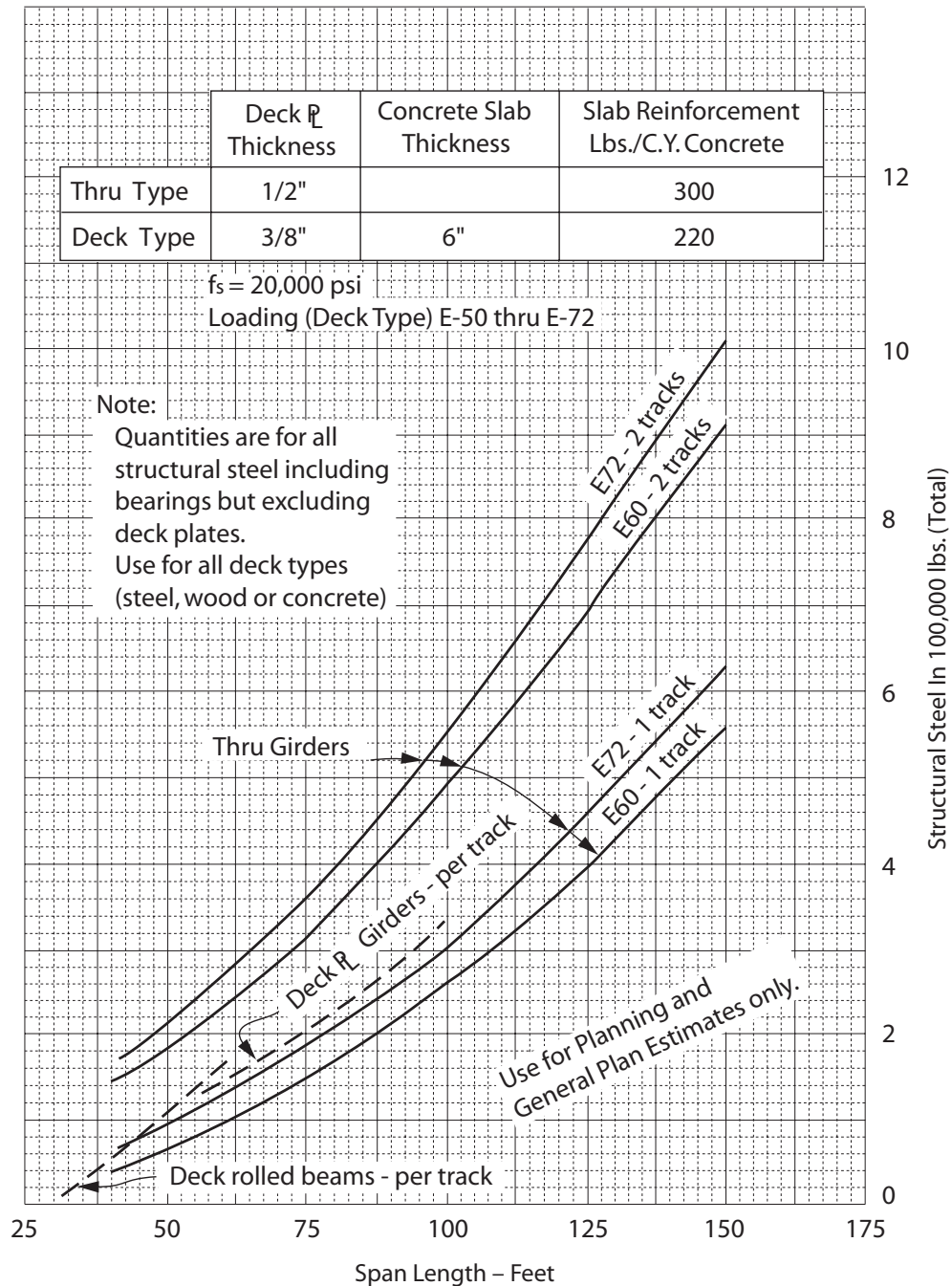


CIP Prestressed Box Girder Prestressing Steel



Simple Span Composite Welded Steel Girder





Railroad Bridge Superstructure
(Structural Steel)

Marginal Estimates

The Marginal Estimate differs from the Advanced Planning and General Plan Estimates in that it is based on quantity calculations prepared from checked design plans. This marginal estimate is done at P&Q stage. Marginal Estimates for bridge items are segregated as follows:

<u>SUPERSTRUCTURE</u>	<u>SUBSTRUCTURE</u>	<u>OTHER ELEMENTS</u>
Concrete	Concrete	Bridge Removal Items
Bar Reinforcing	Bar Reinforcing	Retaining Wall Items
Structural Steel	Excavation	Slope Paving
Joint Seals/Assemblies	Backfill	Approach Slab Items
Deck Seals	Seal Course	Drill and Bond Dowel
Prestressing Steel	Piling	
Misc. Metal (Restrainer)	Architectural Treatment	
Railings and Barriers	Closure Wall	
Architectural Treatment	Drill and Bond Dowel	
PC Girders/Slabs		
PTFE Bearings		
Asphalt Concrete		
Deck Drainage Systems		
Drill and Bond Dowel		

A Marginal Estimate Form should be filled out for each structure, retaining wall, or sound wall with separate bridge number. Whenever there are identical parallel structures or where more than one structure is shown on a General Plan, only one Marginal Estimate Form should be filled out.

Quantity Take-Off Procedures

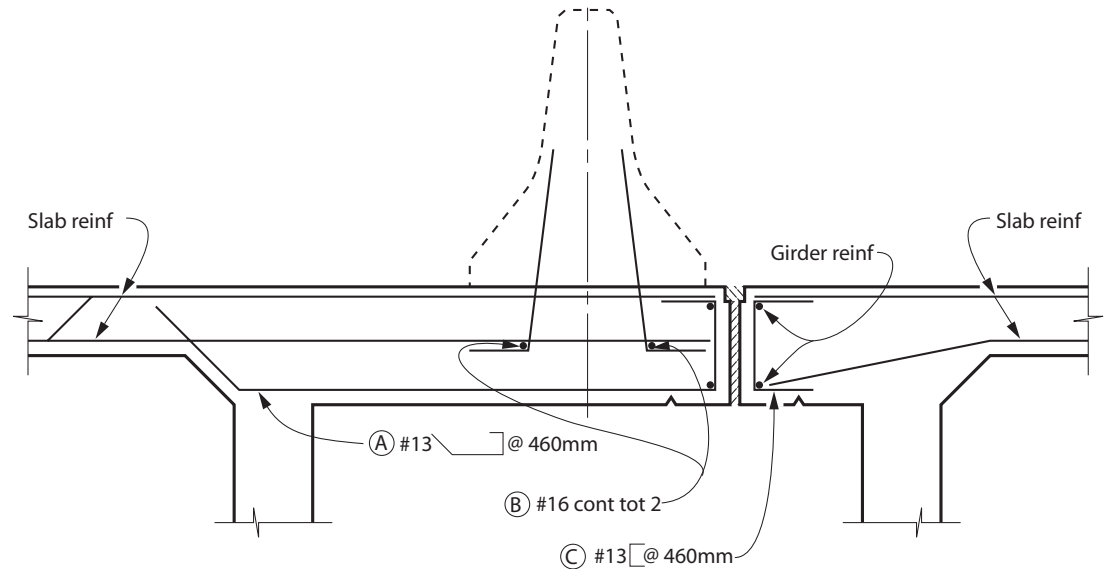
First, determine the limits of each concrete type and the division between superstructure and substructure.

Divide the work into logical units such as footings, columns, etc. Be liberal with descriptions which will identify each unit. Use sketches where necessary for clarity.

If there is doubt whether or not to list an item, list it with a brief explanation. The Specifications Engineer will decide how it should be handled.

Two persons, or groups, will be assigned to independantly calculate quantities for the same structure. They should collaborate to the extent of setting up the same division of units for each

For the more complicated structures or portions of structures, it is suggested that the estimator and checker code (by number or letter) the reinforcing bars on the estimating prints prior to quantity take-off. This will facilitate final checking of quantities and reduce the possibility of omissions. An example is as follows:



Lump Sum Items

Backup quantities are to be submitted for items paid for as “Lump Sum.” Quantities for the item “Bridge Removal” should be calculated either in cubic meters or square meter of bridge deck area. Other Lump Sum items should include a breakdown of quantity of all work involved in the item.

Fully Compensated Items

A fully compensated item, or fully compensated labor and materials, indicates that payment is included in another item of work, and will be defined in the pay clause for that particular item. Fully compensated work is agreed upon by the Specification Engineer and the Structures Estimator, and does not preclude the quantities for the fully compensated work from being provided in the quantity calculations.

Example:

The item Minor Concrete (Minor Structure) might include payment for Structure Excavation, Structure Backfill, and Drill and Bond Dowel. In which case, the quantities for each item should be calculated and provided on the Marginal Estimate, as to facilitate the sum of all costs into one “fully compensated” unit price.

Structure Type Coding

The following coding is to be entered in the “Type” block on the Marginal Estimate summary forms. (See *Appendix*)

The **first** character in the field identifies the major material used or the construction method:

C	–	Concrete
S	–	Steel
T	–	Timber
M	–	Masonry
P	–	P/S, P/C
I	–	P/S, CIP

The **second** and **third** characters describe the physical configuration of the main span:

BG	–	Box Girder	IG	–	“I” girder
SL	–	Slab	IU	–	Inverted U
SS	–	Seal Slab	UG	–	“U” girder
DU	–	Deck Units	WG	–	Welded girder
TG	–	“T” girder	RB	–	Rolled beam
DT	–	Double T	TD	–	Truss deck
IT	–	Inverted T	TC	–	Truss Cantilever
BU	–	Bulb T			
TB	–	Truss Bascule	BW	–	Bin wall
TL	–	Truss lift	PA	–	Pipe, arch
SU	–	Suspension	P1	–	Single pipe
AR	–	Arch	P2	–	Double pipe
LS	–	Log stringer	B1	–	Single box

The **second** and **third** characters (*continued*)

T1	–	Type 1 wall	B2	–	Double box
T2	–	Type 2 wall	B3	–	Triple box
T3	–	Type 3 wall	B4	–	Quadruple box
T4	–	Type 4 wall	B5	–	Quintuple box
T5	–	Type 5 wall	XX	–	None of the above



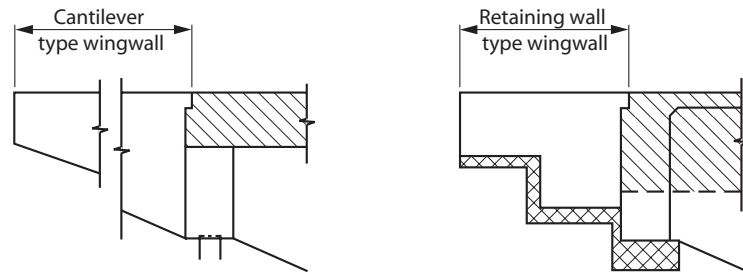
The **fourth** character indicates the function of the structure:

A	–	Undercrossing	M	–	Equestrian undercrossing
B	–	Overcrossing	N	–	Cattle pass undercrossing
C	–	Separation	O	–	Culvert undercrossing
D	–	Underpass	P	–	Pedestrian bridge
E	–	Overhead	Q	–	Pedestrian overcrossing
F	–	Bridge	R	–	Equestrian overcrossing
G	–	Bridge and Overhead	S	–	Pipeline overcrossing
H	–	Viaduct	T	–	Pump house
I	–	Sidehill Viaduct	U	–	Culvert
J	–	Double deck viaduct	W	–	Retaining wall
K	–	Tunnel	X	–	Sound wall
L	–	Pedestrian undercrossing	Z	–	None of the above

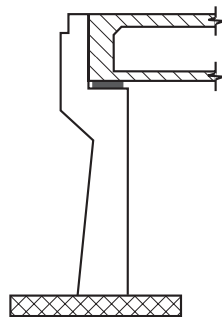
The **fifth** character identifies the nature of construction:

N	–	New	Q	–	Earthquake Retrofit
W	–	Widening	R	–	Raising Bridge
E	–	Extension	U	–	Rail Replacement (Upgrade Rail)
M	–	Modification	F	–	Repair/Rehab

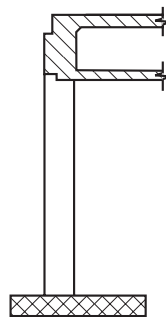
Concrete Type Limits and Division between Superstructure and Substructure



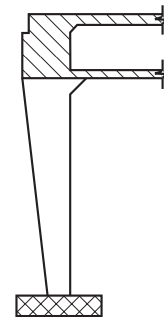
Wingwalls and Diaphragm Type Abutments



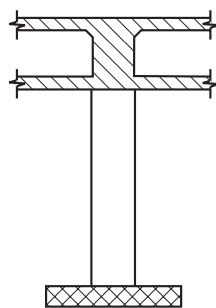
Cantilever Abutment



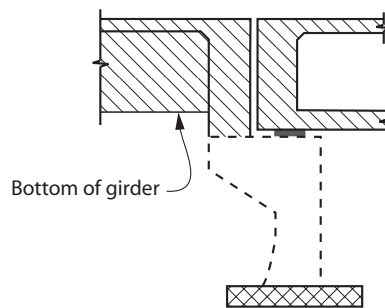
Strutted Abutment



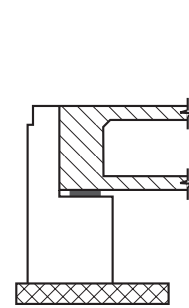
Rigid Frame Abutment



Bent or Pier



Bin Type Abutment



Seat Type Abutment

Notes:

1. For retaining walls that are not classified as wingwalls see sheet ___. Bent Caps, Top Slabs, and Diaphragms for Precast Girder Bridges are paid as Structural Concrete, Bridge.
2. For pile extensions see sheets __.

Superstructure		Structural Concrete, Bridge
Substructure		
		Structural Concrete, Bridge Footing

Quantity Calculations and Summary Sheets

Quantity calculations are to be clearly legible and easy to follow, including sketches and location references. They should be titled properly, identifying the estimator and the checker, the structure name and bridge number, and the date the calculations were performed.

Calculated quantities are to be summarized on Official State forms. The following is a list of forms available.

Form Number	Form Name
DS-D-0015	Pile Summary
DS-D-0016	Bridge General Plan Estimate or Planning Estimate
DS-D-0017	Miscellaneous General Plan Estimate or Planning Estimate
DS-D-0019	Structural Quantity and Marginal Estimate
DS-D-0019A	Marginal Estimate - Miscellaneous Structure Other Than Bridge
DS-D-0019B	Marginal Estimate - Miscellaneous Structure Other Than Bridge (EQ Retrofit)
DS-D-0019SUP	Marginal Estimate - Miscellaneous Structure Other Than Bridge
DS-D-0022	Summary - Structure Excavation and Structure Backfill
DS-D-0050	Concrete Summary
DS-D-0067	Bar Reinforcing Summary
DS-D-0100	Pile Quantity Calculations
DS-D-0110	Reinforcing Steel Quantities
DS-D-0153	Sound Wall Summary
DS-D-0154	Summary – Miscellaneous Metal – Bridge and Restrainer
DS-D-0000	Advance Planning Study & General Plan Estimate Checklist

Notes:

1. Obtain a current copy from the Cost Estimates website.
2. Do not fill out the “USE” column on the Marginal Estimate Sheet. This is for the cost estimator to determine. The cost estimator does any necessary rounding to the quantities per the Ready-to-List and Contract Award Guide (RTL Guide).



Quantity Summaries Transmitted to Resident Engineer's Pending File, After Bid Acceptance

The following forms are available for summarizing certain items for each structure, which are used in making progress pay estimates. Therefore, the breakdown should be subtotals as they would be constructed, and are submitted with the Marginal Estimate to the Cost Estimates Branch, who will forward them to the R.E. Pending File.

- SUMMARY-STRUCTURE EXCAVATION AND STRUCTURE BACKFILL
DS - D0022
- PILE SUMMARY
DS - D0015
- CONCRETE SUMMARY
DS - D0050
- BAR REINFORCING SUMMARY
DS - D0067
- SUMMARY - MISCELLANEOUS METAL - BRIDGE AND RESTRAINER
DS - D0154

Type 5 Retaining Wall Quantities

TYPE 5 RETAINING WALL - QUANTITIES ON **SPREAD FOOTING**

DESIGN H	CONCRETE (m ³ /m)	REBAR (kg/m)
1200	1.02	40
1800	1.31	50
2400	1.77	74
3000	2.31	100
3600	3.37	127

TYPE 5 RETAINING WALL - QUANTITIES ON **PILE FOOTING**

DESIGN H	CONCRETE (m ³ /m)	REBAR (kg/m)
1200	1.17	63
1800	1.35	73
2400	1.84	103
3000	2.41	126
3600	3.41	151

Note: Use for Advanced Plan and General Plan studies only.

Type 1 Retaining Wall Quantities

CONCRETE AND REBAR QUANTITIES PER LENGTH OF WALL FOR TYPE 1 RETAINING WALL ON **400 kN FOOTING**

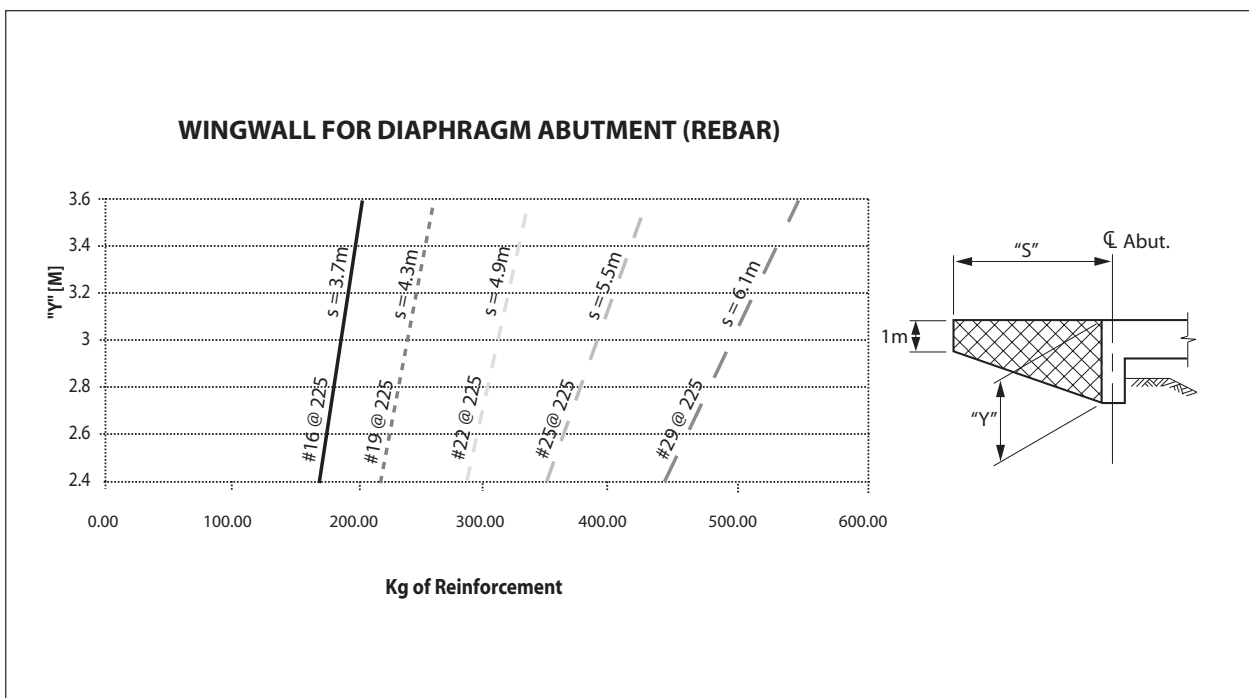
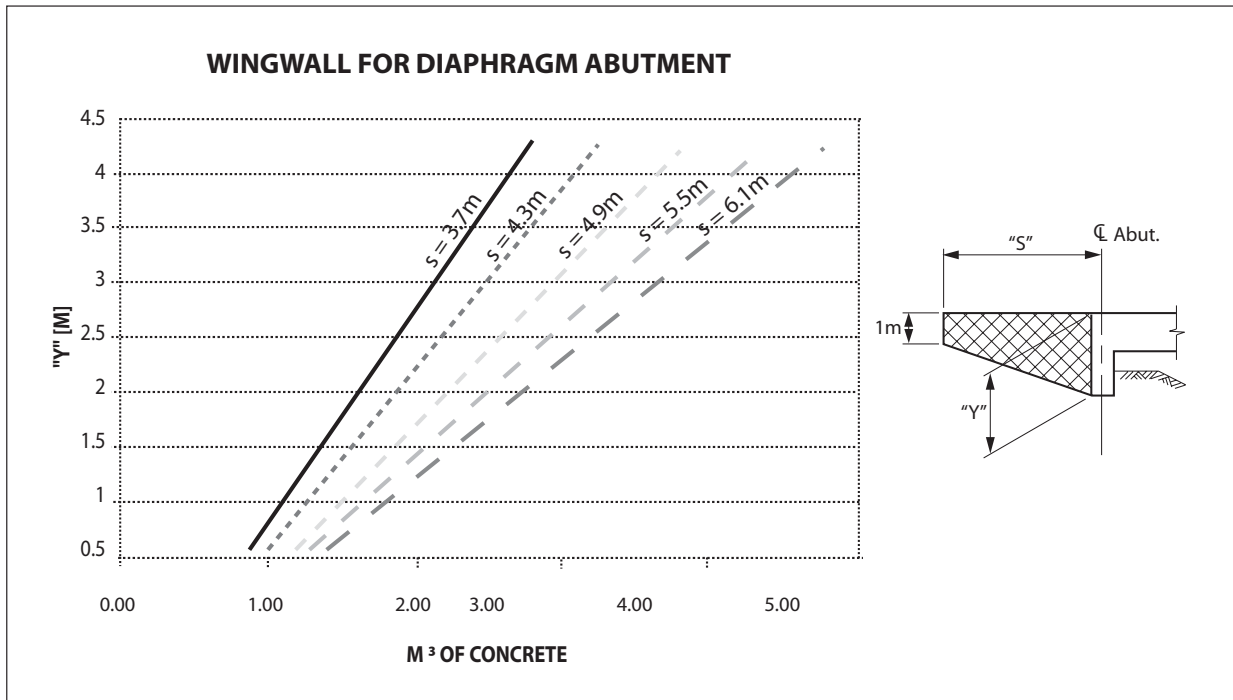
DESIGN H (m)	CONCRETE (m ³ /m)	REBAR (kg/m)
1.2	0.96	61
1.8	1.32	74
2.4	1.69	86
3.0	2.08	132
3.6	2.49	166
4.2	3.01	212
4.8	3.44	257
5.5	3.97	329
6.1	4.45	404
6.7	5.15	527
7.3	6.19	598
7.9	7.57	731
8.5	8.73	890
9.1	10.56	984
9.7	12.94	1109
10.3	14.52	1181
10.9	16.19	1374

Note: Use for Advanced Plan and General Plan studies only.

CONCRETE AND REBAR QUANTITIES PER LENGTH OF WALL FOR TYPE 1
RETAINING WALL ON **SPREAD FOOTING**

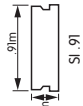
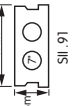
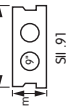
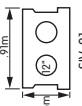
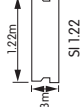
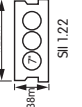
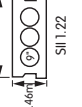
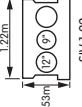
DESIGN H (m)	CONCRETE (m ³ /m)	REBAR (kg/m)
1.2	0.96	39
1.8	1.30	51
2.4	1.65	61
3.0	2.02	79
3.6	2.50	113
4.2	3.00	157
4.8	3.43	201
5.5	3.92	281
6.1	4.38	355
6.7	5.05	477
7.3	6.07	558
7.9	7.42	690
8.5	8.56	848
9.1	10.35	940
9.7	12.70	1062
10.3	14.26	1132
10.9	15.91	1326

Note: Use for Advanced Plan and General Plan studies only.

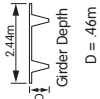
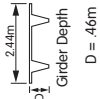
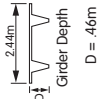
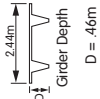
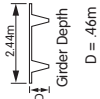
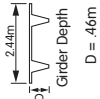
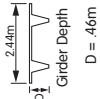
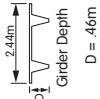


Note: See Standard Plan B0-1

Precast Prestressed Concrete Slab Quantities

915 mm Width Typical Sections	Girder Length mm	Pf Kn	No. 13 mm Strands	Mass 13 Strand Kg	Mass of Bar Reinf Kg	Vol of Conc m3
	6096 6401	917 1006	3353 3658	52.16 59.88	196.86 204.57	1.60 1.68
	6706 7010 7315 7620 7925 8230 8534 8839 9144 9449 9754	659 721 783 846 912 975 1041 1113 1175 1250 1317	2438 2743 2743 3048 3353 3353 3658 3962 4267 4572 4572	41.73 48.99 51.26 59.42 67.59 70.31 79.38 89.36 99.34 110.22 113.40	185.52 190.97 196.41 201.85 207.30 212.74 218.18 223.62 229.07 234.51 239.95	1.90 1.98 2.06 2.16 2.24 2.32 2.41 2.49 2.58 2.67 2.75
	10058 10363 10668 10973 11278 11582 11887 12192 12497	1010 1068 1121 1188 1250 1308 1384 1464 1544	3353 3658 3658 3962 4267 4267 4572 4877 5182	86.18 96.62 99.34 110.68 122.47 126.10 138.35 151.50 165.11	258.10 264.00 269.44 275.34 281.23 286.68 292.57 298.02 303.91	3.20 3.30 3.39 3.49 3.59 3.69 3.78 3.88 3.98
	12802 13106 13411 13716 14021 14326 14630	1215 1282 1344 1415 1477 1540 1606	3962 4267 4572 4877 5182 5483	129.28 142.43 156.04 170.55 174.18 189.15 204.57	319.79 325.68 332.04 337.93 343.83 349.73 355.62	4.14 4.24 4.34 4.43 4.53 4.63 4.73
1220 mm Width Typical Sections	Girder Length mm	Pf Kn	No. 13 mm Strands	Mass 13 Strand Kg	Mass of Bar Reinf Kg	Vol of Conc m3
	6096 6401	1224 1339	4267 4572	66.23 74.84	265.36 275.34	2.16 2.27
	6706 7010 7315 7620 7925 8230 8534 8839 9144 9449 9754	863 935 1032 1117 1202 1286 1375 1464 1553 1647 1740	3048 3353 3658 3658 3962 4267 4572 4877 5182 5486 6096	52.16 59.88 68.04 71.22 79.83 89.36 99.34 109.77 120.66 132.00 151.50	249.48 256.74 264.00 271.71 278.96 286.22 293.48 301.19 308.45 314.34 322.96	2.52 2.64 2.75 2.87 2.98 3.10 3.21 3.33 3.44 3.55 3.66
	10058 10363 10668 10973 11278 11582 11887 12192 12497	1335 1397 1473 1553 1633 1713 1811 1918 2020	4572 4877 4877 5182 5486 5791 6096 6401 6706	117.03 128.82 132.45 144.70 157.40 171.01 184.62 198.68 213.19	347.91 355.62 363.33 371.04 378.76 386.47 394.18 401.89 409.60	4.23 4.36 4.48 4.61 4.73 4.86 4.99 5.12 5.24
	12802 13106 13411 13716 14021 14326 14630	1633 1718 1807 1896 1985 2069 2172	5486 5791 6096 6401 6706 7010 7315	178.72 193.23 208.20 223.62 239.50 255.83 272.61	430.92 439.08 447.25 455.41 463.13 471.29 479.46	5.70 5.83 5.97 6.10 6.24 6.38 6.51

Precast Prestressed Concrete Slab Quantities (cont.)

915 mm Width Typical Sections	Girder Length mm	Pf Kn	No. 13 mm Strands	Mass 13 Strand Kg	Mass of Bar Reinf Kg	Vol of Conc m3
	9144	1291	4267	100.25	193.23	2.51
	9449	1357	4267	103.42	198.68	2.59
	9754	1428	4267	106.60	204.12	2.68
	10058	1504	4267	110.22	209.56	2.76
	10363	1575	4877	129.73	215.01	2.84
	10668	1647	4877	133.36	220.45	2.93
	10973	1638	4877	136.99	225.89	3.01
	11278	1789	5486	158.76	231.34	3.10
	10668	1117	3658	99.79	238.59	3.36
	10973	1193	3658	102.51	244.49	3.46
	11278	1268	3658	105.69	250.39	3.56
	11582	1348	4267	126.55	256.28	3.66
	11887	1424	4267	129.73	262.18	3.75
	12192	1504	4267	133.36	268.08	3.85
	12497	1580	4877	156.04	273.97	3.95
	12802	1660	4877	160.12	279.87	4.04
	13106	1736	5486	184.16	285.77	4.14
	13411	1816	5486	188.24	291.66	4.24
	13716	1891	5486	192.78	297.56	4.34
		13411	1313	4267	146.51	317.52
13716		1380	4267	149.69	323.87	5.15
14021		1566	4267	153.32	330.22	5.27
14326		1513	4267	156.49	336.57	5.38
14630		1580	4877	182.80	342.92	5.50
14935		1647	4877	186.43	349.27	5.62
15240		1713	4877	190.51	355.62	5.73
15545		1780	5486	218.64	361.97	5.85
15850		1847	5486	222.72	368.32	5.96
16154		1914	5486	227.25	374.67	6.08
	16459	1980	6096	257.19	381.02	6.19
	16764	2047	60.96	261.73	387.37	6.32
	17069	2114	6096	266.72	393.72	6.44
	17374	2181	6706	298.47	400.08	6.54
	17678	2247	6706	303.91	406.43	6.66
	17983	2314	6706	308.90	412.78	6.77
	18288	2381	7315	342.92	419.13	6.89
	18593	2448	7315	348.82	425.48	7.00
	18898	2514	7315	354.26	431.83	7.12
	19202	2581	7925	390.10	438.18	7.23
	13411	1375	4267	146.97	320.24	5.87
	13716	1446	4267	150.14	326.59	6.01
	14021	1517	4877	166.92	332.94	6.15
	14326	1589	4877	179.17	339.29	6.29
	14630	1660	4877	182.80	345.64	6.42
	14935	1731	5486	210.02	351.99	6.55
	15240	1802	5486	214.55	358.34	6.69
	15545	1873	5486	218.64	364.69	6.82
	15850	1945	6096	247.67	371.04	6.96
	16154	2016	6096	252.66	377.40	7.09
	16459	2087	6096	257.19	383.75	7.23
	16764	2158	6706	288.04	390.10	7.36
	17069	2229	6706	293.48	396.45	7.50
	17374	2301	6706	298.47	402.80	7.62
	17678	2372	7315	331.58	409.15	7.77
	17983	2443	7315	337.02	415.50	7.89
	18288	2514	7315	342.92	421.85	8.04
	18593	2585	7925	377.85	428.20	8.16
	18898	2657	7925	383.75	434.55	8.30
	19202	2728	7925	390.10	440.90	8.43
	13411	1375	4267	146.97	320.24	5.87
	13716	1446	4267	150.14	326.59	6.01
	14021	1517	4877	166.92	332.94	6.15
	14326	1589	4877	179.17	339.29	6.29
	14630	1660	4877	182.80	345.64	6.42
	14935	1731	5486	210.02	351.99	6.55
	15240	1802	5486	214.55	358.34	6.69
	15545	1873	5486	218.64	364.69	6.82
	15850	1945	6096	247.67	371.04	6.96
	16154	2016	6096	252.66	377.40	7.09
	16459	2087	6096	257.19	383.75	7.23
	16764	2158	6706	288.04	390.10	7.36
	17069	2229	6706	293.48	396.45	7.50
	17374	2301	6706	298.47	402.80	7.62
	17678	2372	7315	331.58	409.15	7.77
	17983	2443	7315	337.02	415.50	7.89
	18288	2514	7315	342.92	421.85	8.04
	18593	2585	7925	377.85	428.20	8.16
	18898	2657	7925	383.75	434.55	8.30
	19202	2728	7925	390.10	440.90	8.43

Sources of Quantities for Standard Details

SP = Standard Plans BDD = *Bridge Design Details* BDA = *Bridge Design Aids*

Concrete and Reinforcing:

Retaining Wall, Type 1	SP B3-1 and B3-2
Cantilever Abutments	BDD Section 6
Strutted Abutments	BDD Section 20
Cantilever Wingwalls	BDD Section 20
Standard Slab Bridges	BDA Section 4

Steel:

Reinforcing Bar Weights	BDA 11-37
Piling Patterns – Retaining Walls	BDD Section 6
Piling Patterns – Cantilever Abutment	BDD Section 6
Railroad Track, Ballast, etc.	BDD Section 12

Commonly Used Quantities and Factors

Access Door to Cellular Abutment 0.6M × varies,, Standard Plan B0-13

Area Drain, Standard Plan B7, 5.5 kg

Asphalt Concrete 2,385 kg per M³

Batter Factors:

$$1:3 = 1.0541 \quad 1:5 = 1.0198$$

$$1:4 = 1.0308 \quad 1:6 = 1.0138$$

Deck Drain Type C, 141 kg., Frame and Grate only

Deck Drain Type D-1, 66 kg.

Deck Drain Type D-2, 56 kg.

Deck Drain Type D-3, 59 kg.



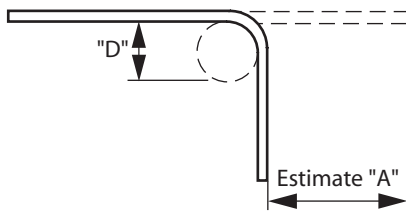
Deck Drain Type A, 8 kg., Grate only
Drain Pipe, 150 mm (3.4mm), 12.77 kg/M.
Epoxy Adhesive Bond Coat, 2L. per 1 M²
Equalizing Bolt @ Hinge – 20 kg., Miscellaneous Metal (Bridge) (1.2 M Hinge Width)
Galvanizing, add 3% to mass of metal
Hinge Assembly, Standard Slab 0.3 M Depth, 280 kg. per M
Ladder Rung, 3 kg. each (For MHs, catch basins, etc.)
Manhole Frame and Cover-Deck (Detail B7-11) 200 kg.
Manhole Frame and Cover Sidewalk (Detail B7-11) 110 kg.
Prestressing Steel – See Item Description
Reinforcing Steel Weights – See Appendix
Rock Base Material, RR Ballast, 1,940 kg. per M³
Slurry Leveling Course, 1 L. per 2.5 M²
Steel: 7,792 kg per M³
Aluminum: 2,730 Kg/M³

Earthquake Restrainers – Commonly Used Masses for Miscellaneous Metal

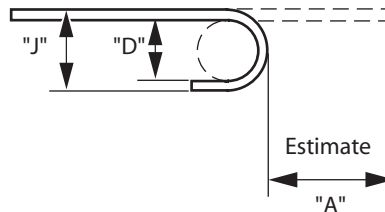
Swage fitting w/stud, nut, and jam nut	2.8	KG each
PL 250 mm × 250 mm.	26	KG each
Cable Drum – Type C-1	17.7	KG each
25 mm. Nut	0.14	KG each
19 mm. Galvanized Strand	1.54	KG/M (1.49 Ungalvanized)
32 mm in. H.S. Rod	6.48	KG/M
25 mm. Stud	4.00	KG/M
PL 25 mm × 125 mm.	25.09	KG/M
Galvanizing and welds	Add 3%	

Reinforcing Bar Data - Grade 420 (ACI 318-89)

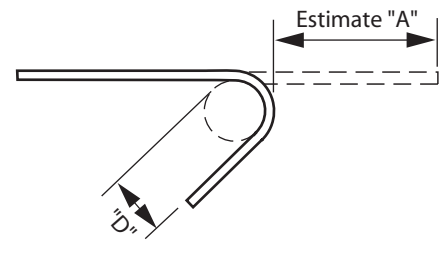
Physical Properties				Hook Dimensions						
Bar Size	Weight (kg/m)	Nominal Diameter (mm)	Area (mm ²)	Standard				Stirrups and Ties		
				"D"	90°	180°		"D"	90°	135°
					"A"	"J"	"A"		"A"	"A"
10	0.560	9.5	71	60	150	80	125	40	105	105
13	0.994	12.7	129	80	200	105	150	50	115	115
16	1.552	15.9	199	95	250	130	175	65	155	140
19	2.235	19.1	284	115	300	155	200	115	305	205
22	3.042	22.2	387	135	375	180	250	135	355	230
25	3.973	25.4	510	155	425	205	275	155	410	270
29	5.060	28.7	645	240	475	300	375	--	--	--
32	6.404	32.3	819	275	550	335	425	--	--	--
36	7.907	35.8	1006	305	600	375	475	--	--	--
43	11.38	43.0	1452	465	775	550	675	--	--	--
57	20.24	57.3	2581	610	1050	725	925	--	--	--



90° Standard / 90° Stirrup and Tie



180° Standard



135° Tie Hook



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Item Descriptions and Limits and Methods of Payment

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Description of Contract Items

Bar Reinforcing Steel

- Quantity calculated in kilograms.
- Two sets of quantity calculations should agree within 3% for each bar size.

Include:

1. Splices shown on the plans either graphically or in tabular form. See Appendix for lengths. Where lapped bars are of two sizes, use splice length based on the smaller bar.
2. An additional 2% for lap splices not shown on plans, as shown at bottom of Bar Reinforcing Summary Sheet.
3. Bond and anchorage lengths, see *Bridge Design Details*, Section 13, or consult designer.
4. Bar hooks, use “standard” unless dimensioned otherwise.
5. Dowels, grouted or bonded in drilled holes, except those for concrete barrier railings, and diaphragm bolsters.
6. Reinforcement for Cast-In-Place Concrete piling 600 mm and larger.
7. Reinforcement in anchorages for CIP prestress girders.
8. Longitudinal reinforcement in stirrup hooks of precast girders, see *Bridge Design Details*, Section 14.
9. Reinforcement around utility openings. See Standard Plans.
10. Bar chairs shown on plans.
11. Longitudinal bars at edge of deck and under railings.
12. Stirrup reinforcement at abutments, see *Bridge Design Details* 6-24.

Note:

- When calculating final quantities for standard slab bridges, do not use the approximate tabular data in BDA Section 4.

Do *not* include reinforcement or Epoxy coated reinforcement in:

1. Precast members (girders, walls, piling, panels, etc.)

Reinforcing for precast girders is shown on the marginal (final) estimate for use in pricing for nonstandard girders only. For nonstandard girders use 75 kg per m³.

2. Cast-In-Place Concrete Piling less than 600 mm
3. Concrete barriers
4. Bridge approach slabs
5. Bridge slope paving
6. Diaphragm bolsters for hinge restrainers
7. Hairpins in steel pile anchorages
8. Closure walls
9. Sound walls – precast or masonry block
10. Deck access closure (usually for EQ restrainers)
11. Ripped texture (reinforcement used to create ripped texture)
12. Concrete crib walls
13. Cable anchorages for railings
14. Concrete panels for reinforced earth walls
15. Supply line cradles
16. Concrete classified as “Minor” (Gutters, etc.)
17. Soil Nails
18. Expansion dams

Bar Reinforcing Steel (Epoxy Coated)

1. Estimate in kilograms (Add 2% for splices not shown on the plans)
2. The Specifications Engineer must be advised of all locations where epoxy-coated bar reinforcing steel is used.
3. Tabulate the quantity of Bar Reinforcing Steel (Epoxy-Coated) separately, except for reinforcing in concrete barrier railings, pilings less than 600 mm and precast members.
4. Use bar masses the same as for uncoated bars. (No allowance is made for the mass of epoxy.)
5. If any portion of a bar requires epoxy-coating, the entire bar will be coated.

6. Decks and Approach Slabs: In Environmental Area III, and some other corrosive environments, the deck and approach slab reinforcing steel is to be epoxy-coated.

Decks 300 mm thick and less:

Epoxy-coat the entire deck reinforcing.

Decks greater than 300 mm thick:

Refer to *Memo to Designers*, Section 8.

In all cases, the reinforcing in abutment, bent and girder diaphragms is to be coated to the same depth as the adjacent deck.

Bar Reinforcing Steel (Retaining Wall)

1. Estimate in kilograms. Tabular values do not include reinforcement in haunch when concrete barrier is attached at top; therefore, this must be added to the tabular values.
2. The specifications engineer must be advised of all locations where epoxy-coated bar reinforcing steel is used.

Headed Bar Reinforcement

1. Estimate in EACH units (each head).

Concrete

Seal Course Concrete

1. Estimate in cubic meters per limits shown on plans.
2. This item is for concrete placed under water and is designated on the plans as Seal Course Concrete.
3. See *Bridge Design Details*, Section 7.

Structural Concrete, Approach Slab (Type N)

1. Estimate in cubic meters.
2. Included in the item price per cubic meter is everything shown on the approach slab sheets, including structure approach drainage system, geocomposite drain, plastic pipe, drainage pads, treated permeable base, filter fabric, woven tape fabric, miscellaneous metal, pourable seals, epoxy-coated bar reinforcement and epoxy-coated miscellaneous bridge metal, transverse joint seals at sleeper slabs, water stops, and sliding joints.

Structural Concrete, Approach Slab (Type EQ)

1. Estimate in cubic meters.
2. Included in the item price per cubic meter is everything shown on the approach slab sheets, such as miscellaneous bridge metal, pourable seals, epoxy-coated bar reinforcement, and epoxy-coated miscellaneous bridge metal.

Structural Concrete, Approach Slab (Type R)

1. Estimate in cubic meters.
2. For use where new approach slabs are desired at existing bridges; replacing PCC slabs or AC paving.
3. Curing time for Type R approach slabs may require as little as 4 hours with use of chemical admixtures, depending on lane closure restrictions. Otherwise, 5 days is standard cure time.
4. Separate quantities for Aggregate Base (Approach Slab) will be required, and it is assumed to be 10% of the volume of the Structural Concrete, Approach Slab (Type R).
5. At PS&E, the designer should indicate in the "Memos to Specifications Engineer" whether mudjacking was used under the existing approach slabs. Check bridge maintenance records for this condition.
6. Included in the item price per cubic meter are removing and disposing of portions of the existing structure and pavement materials, furnishing and placing miscellaneous metal, epoxy-coated bar reinforcement, drilling and bonding of bar reinforcement or abutment tie rods, and Type AL joint seals.

Structural Concrete, Bridge

1. Compute in cubic meters from plan dimensions.
2. Do not deduct for volumes occupied by reinforcing steel, prestressing steel, miscellaneous metal, structural steel, piling, drain pipes or joint filler.
3. Deduct for utility openings.
4. Do not deduct for access openings in soffit.
5. Include bent caps, slab, and diaphragms for precast girder superstructures.

Structural Concrete, Bridge Footing

1. Compute in cubic meters from plan dimensions.
2. Includes all concrete designated on the plans as bridge footing concrete.
3. Do not deduct for volumes occupied by reinforcing steel or piling.

Minor Concrete

1. Estimate in cubic meters.
2. This pay item will include necessary earthwork and reinforcing steel.

Structural Concrete, Lightweight

1. Estimate in cubic meters to limits shown on the plans, and report separately on Marginal Estimate and Concrete Summary form.
2. Do not deduct for volumes occupied by reinforcing steel.

Structural Concrete, Pier Column

1. Estimate in cubic meters to limits shown on the plans.
2. This item is for concrete placed in excavated (mined) shafts.
3. Do not deduct for volumes occupied by reinforcing steel.

Structural Concrete, Retaining Wall (Not Bridge Wingwall)

1. Estimate in cubic meters.
2. Retaining Walls that have a retaining wall number are not classified as wingwalls and are paid for as Structural Concrete, Retaining Wall.
3. Wingwalls for abutments, even though they consist of lengths of standard retaining walls, will normally be considered as Structural Concrete, Bridge, unless the wingwall is part of a retaining wall that has a retaining wall number assigned or the retaining wall is greater than 15 meters in length.
4. Do not deduct for volumes occupied by reinforcing steel.

Slope Paving

1. Estimate the cubic meters of concrete. This pay item will include necessary earthwork and reinforcing steel.
2. Estimate permeable material in cubic meters.
3. Estimate drainage inlets by each.
4. Estimate drain pipes in linear meters for each size and type.
5. Do not deduct for volumes occupied by reinforcing steel.

Deck Rehabilitation Items

Remove Unsound Concrete	CM	Use M ² from chain survey
Remove Deck Surfacing	M ²	Assumed to be AC
Asphalt Concrete (Type B)	TONNE	M ³ × 2.28 = TONNE
Epoxy Adhesive (Bond Coat)	L	2L per 1 M ² use with PCC patch and PCC exp. dam.
Portland Cement Concrete (Patch)	M ³	Usually same quantity as Remove Unsound Concrete
Expansion Dam	M ³	Includes reinf. and dowels
Deck Seal	M ²	Lx(W + .5) includes primer

Slurry Leveling Course	L	2.5 L per 1 M ² . Use on rough decks only
Joint Seal	M	Indicate MR
Rapid Setting Concrete (Patch)	M ³	
Clean Bridge Deck	M ²	
Furnish Bridge Deck Treatment	L	
Treat Bridge Deck	M ²	
Asphalt Concrete (Type B)	TONNE	For shoulders
Remove Unsound Concrete	M ³	
Scarify Concrete Surface	M ²	Include approaches
Deck Overlay (Concrete)	M ³	
Saw Concrete Joint	M	
Furnish Polyester Concrete Overlay	M ³	
Place Polyester Concrete Overlay	M ²	
Rapid Setting Concrete (Deck Overlay)	M ³	
Prepare Concrete Bridge Deck Surface	M ²	

Earthquake Restrainers, Retrofit, and Repair

Access Opening, Deck	EA
This includes the concrete removal work.	
Access Opening, Soffit (For existing structures only)	EA
This includes the concrete removal work and the closing steel plate pour assembly.	
Minor Concrete (Minor Structure)	M ³
This item will cover a variety of abutment blocks, shear blocks, bent blocks, pedestal supports, etc. It includes concrete, bar reinforcing, drill and bond dowels and excavation and backfill if needed, if the total quantity is small.	
Diaphragm Bolster	EA
These are used to reinforce concrete girders. The item includes concrete, bar reinforcing, and drill and bond dowels.	

Close Access, Deck	EA
This includes concrete (any type), bar reinforcing and the temporary steel cover plate.	
Core Concrete (each size)	M
Miscellaneous Metal (Restrainer)	KG
Include all metal involved in the restrainers. Provide separate estimates for cable type, pipe type, and rod type. Deduct for holes. Ignore small non-repetitive copes and cuts. Add 3% for galvanizing and welds.	
Tiedown Anchor	EA
Includes core concrete through footing.	
Asphalt Membrane Waterproofing	M ²
Column Casing (Steel)	KG
Includes casing, grout and seal, expanded polyethylene, welding, backup plates, drain extension, and cleaning and painting structural steel. Earthwork separate.	
See "Column Casing - Steel" under "Miscellaneous" in this section for masses for Square meters.	

Drill and Bond Dowel

1. Calculate length in the unit meters of drilled hole.
2. Reinforcement will be paid for as bar reinforcing steel.

Drill and Bond Dowel (Epoxy Cartridges)

1. Paid by the unit EACH.
2. Reinforcement will be paid as bar reinforcing steel.
3. Installation per manufacturers specifications . DO NOT indicate hole depth on plans.

Hinge Hold Down (Temporary)

1. Paid by the unit EACH.
2. Specify by type – prestressed or dead load.

Temporary Support (Existing Superstructure)

1. Paid by the unit EACH.
(Provide square meter of supported area.)

Earthwork

Structure Backfill or Structure Backfill (Bridge)

1. Paid by the unit cubic meters.
2. See Standard Plans for limits of payment.
3. Deduct volume of concrete within the excavation limits, except for crib walls.
4. Deduct pervious and/or permeable material, if any.
5. Compute quantity only at those locations where backfill must be compacted.
Compaction of backfill is not required in waterways or channel areas which are not beneath embankments, pavements, or slope protection.
6. Do not calculate quantity for structure excavation or backfill directly related to bridge removal.

Structure Backfill (Retaining Wall)

1. Paid by the unit cubic meters.
2. Use when Structural Concrete (Ret. Wall) is required.
3. See Standard Plans for limits of payment.

Structure Excavation or Structure Excavation (Bridge)

1. Paid by the unit cubic meters.
2. See Standard Plans for limits of payment.
3. When plans require concrete to be placed against undisturbed material, the quantity shall still be calculated with widths 300 mm outside the concrete dimensions.
4. Where bridge approach embankments are to be surcharged, the placing and removal of excess material will be paid as a separate district item.

5. The grading plane may be assumed to be 450 mm below finished pavement.
6. Where the volumes of Structure Excavation and Remove Concrete overlap:
 - Case 1. If there is no item of work (on the entire contract) for removing concrete and the amount is minor and lies within the limits of payment for structure excavation, it can be included and paid for as structure excavation. Inform Specifications Engineer.
 - Case 2. If there is an item for Remove Concrete, either by M³ or LS, deduct the volume of concrete only from the structure excavation volume.
 - Case 3. If there is an item for Bridge Removal, deduct the volume of concrete and related excavation from the structure excavation volume.

If it would clarify the situation in either Case 2 or Case 3, draw a separate pay limit diagram on the plans.

Structure Excavation (Type A)

1. Paid by the unit cubic meters.
2. Use where excavation will be below water level.
3. Use only when seal course is shown.

Structure Excavation (Type D)

1. Paid by the unit cubic meters.
2. Use where ground water is anticipated, but a seal course is not shown.
3. Note or details should be shown on the plans.

Structure Excavation (Retaining Wall)

1. Paid by the unit cubic meters.
2. Use when Structural Concrete (Retaining Wall) is required.
3. See Standard Plans for limits.



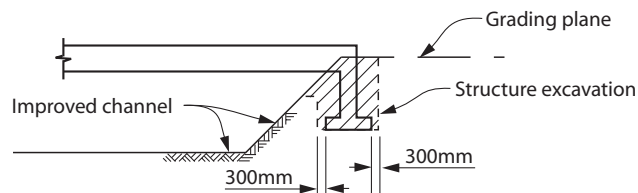
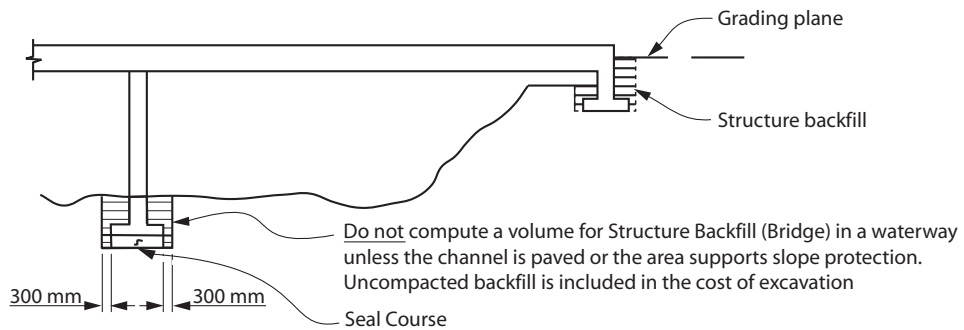
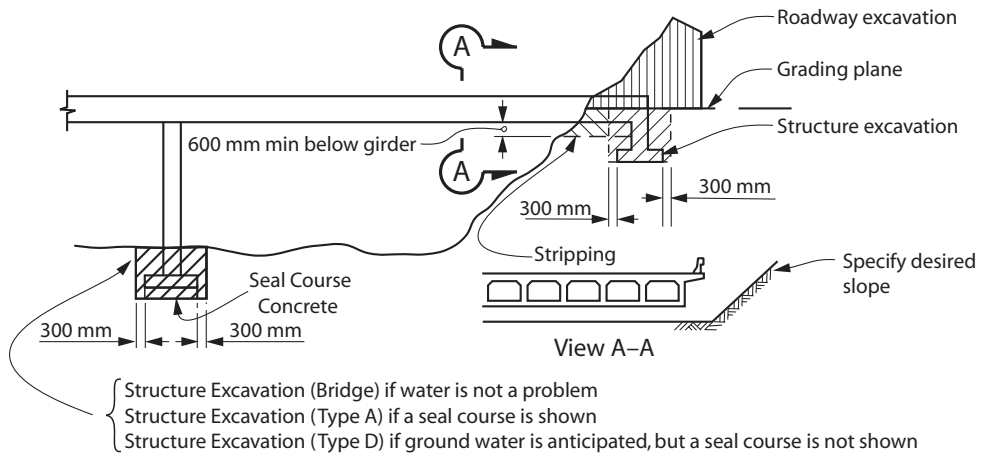
Structure Excavation (Pier Column)

1. Paid by the unit cubic meters.
2. Use for excavated (Mined) shafts.
3. Use with Structural Concrete (Pier Column)
4. Calculate quantity to 150 mm outside concrete dimensions, see *Bridge Design Details*, Section 7-20.

Pervious or Permeable Backfill Material

1. Paid by the unit cubic meters.
2. See Standard Plans for limits.

Excavation and Backfill in Waterways



Joint Seals

Joint Seal (All Types)

1. Paid by the unit meters.

Joint Seal (Movement Rating 50 mm or Less)

1. Paid by the unit meters for each MR.
2. See Standard Plan B6-21 for pay limit extension at low side of the deck.

Joint Seal Assembly (Movement Rating More than 50 mm)

1. Paid by the unit meters for each MR.
2. See Bridge Standard Detail Sheet XS-12-59, for pay limit extension at the low side of the deck.

Metal

Miscellaneous Metal (Bridge)

1. Paid by the unit kilograms, add 3% if galvanized.
2. The Standard Specifications (75-1.03) lists the items to be paid as Miscellaneous Metal (Bridge).
3. Miscellaneous metal in connection with prestressing, such as anchorages, saddles, ducts, etc., are not paid as miscellaneous metal (Bridge). These are included in payment for Prestressing CIP Concrete.
4. Estimate the mass of manhole frame and covers when they are to be paid for by the State. Sometimes they are furnished to the contractor by the utility company.
5. Bridge Deck Drainage System paid separately.
6. Do not calculate mass for access opening plates. They are included in the cost of concrete for new construction and in the cost of Soffit Access Openings for existing structures.

Piling (Excluding CISS)

Furnish Piling

1. Paid by the unit meters from specified tip to cut-off elevation. Battered piles are measured as the total length of pile along the pile centerline.
2. A separate pay item is required for each type or class of piling.

Drive Piles

1. Paid by the unit each, for each type or class of pile.

Cast-In-Drilled-Hole (CIDH) Concrete Piling

1. Paid by the unit meters from specified tip to cut-off elevation.
2. For piles less than 600 mm in diameter, the price of the pile includes all bar reinforcing steel, including reinforcement which extends into a footing, cap, or deck.
3. For piles 600 mm in diameter and larger, compute the weight of bar reinforcing steel and include with Bar Reinforcing Steel (Bridge). Add pile reinforcement, including reinforcement which extends into a footing, cap, or deck, and any spirals or hoops used to confine this pile reinforcement, to the "other" column on the Bar Reinforcing summary sheet.
4. Use only the standard size diameters as shown in Attachment 3 of Memo to Designers 3-1. For diameters less than 1.0 meter, the item name shall include the diameter in millimeters. For diameters greater than or equal to 1.0 meter, the item name shall include the diameter in meters. This does not apply to CIDH concrete piles with permanent steel casings.

Permanent Steel Casing

1. Paid by the unit meter from cut-off elevation to specified tip of the permanent steel casing. If there is any geotechnical capacity required along the length of the steel, it is not a "casing". This item covers furnishing and installing the permanent steel casing; no separate "drive" item is necessary. For the rare case where a CIDH concrete pile requires geotechnical capacity along the length of the steel casing, and a CISS concrete pile is not appropriate, the item "Driven Steel Shell" will be used and will be measured and paid for in the same manner as a permanent steel casing.

Cast-In-Drilled-Hole Concrete Piling (Rock Socket)

1. Paid in the unit meter from the specified tip of the rock socket to the specified tip of the permanent steel casing (or to the specified tip of the larger diameter CIDH concrete pile if no casing is shown on the plans).
2. For piles less than 600 mm in diameter, the price of the pile includes all bar reinforcing steel, including reinforcement which extends above the rock socket.
3. For piles 600 mm in diameter and larger, compute the quantity of bar reinforcing steel and include it in the Bar Reinforcing Steel (Bridge) item. This pile reinforcement, including reinforcement which extends above the rock socket, and any spirals or hoops used to confine this pile reinforcement, should be added to the "other" column on the Bar Reinforcing summary sheet.
4. Use only the standard size diameters as shown in Attachment 3 of Memo to Designers 3-1.

Cast-In-Steel-Shell (CISS) Concrete Piling

Furnish Cast-In-Steel-Shell Concrete Piling

1. Paid by the unit meter from specified tip to cut-off elevation.
2. Use standard Nominal Pipe Size (NPS) sizes for pile diameters less than or equal to 1500 mm.
3. Use outside pile diameter in meters for pile diameters greater than 1500 mm.
4. For pile sizes less than 600 mm in diameter, the price of the pile includes all bar reinforcing steel, including reinforcement which extends into a footing, cap, or deck.
5. For pile sizes 600 mm in diameter and larger, compute the weight of bar reinforcing steel and include with Bar Reinforcing Steel (Bridge). This pile reinforcement, including reinforcement which extends into a footing, cap, or deck, and any spirals or hoops used to confine this pile reinforcement, should be added to the "other" column on the Bar Reinforcing summary sheet.
6. This item includes furnishing of both steel shell and concrete filling.
7. A separate item is required for each diameter of piling.



Drive Cast-In-Steel-Shell Concrete Pile

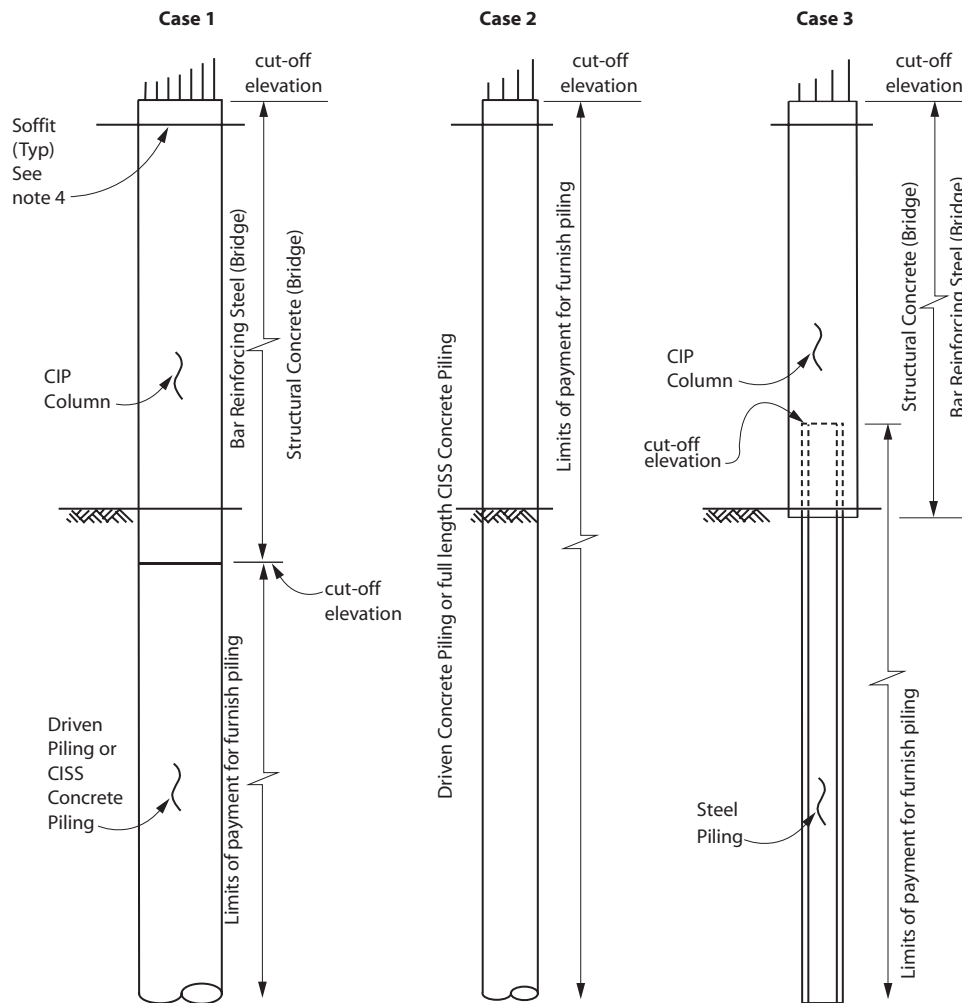
1. Estimate by each, for each diameter of piling.
2. Includes driving the shell, clean-out of the shell, and placement of the concrete filling.

Non-Standard Piling

Micropiles

1. Paid by the unit each.
2. Includes furnishing and installing the micropile (including casings, grout, reinforcement, and anchorages).

*Pile Extensions and Columns for Driven Piles**

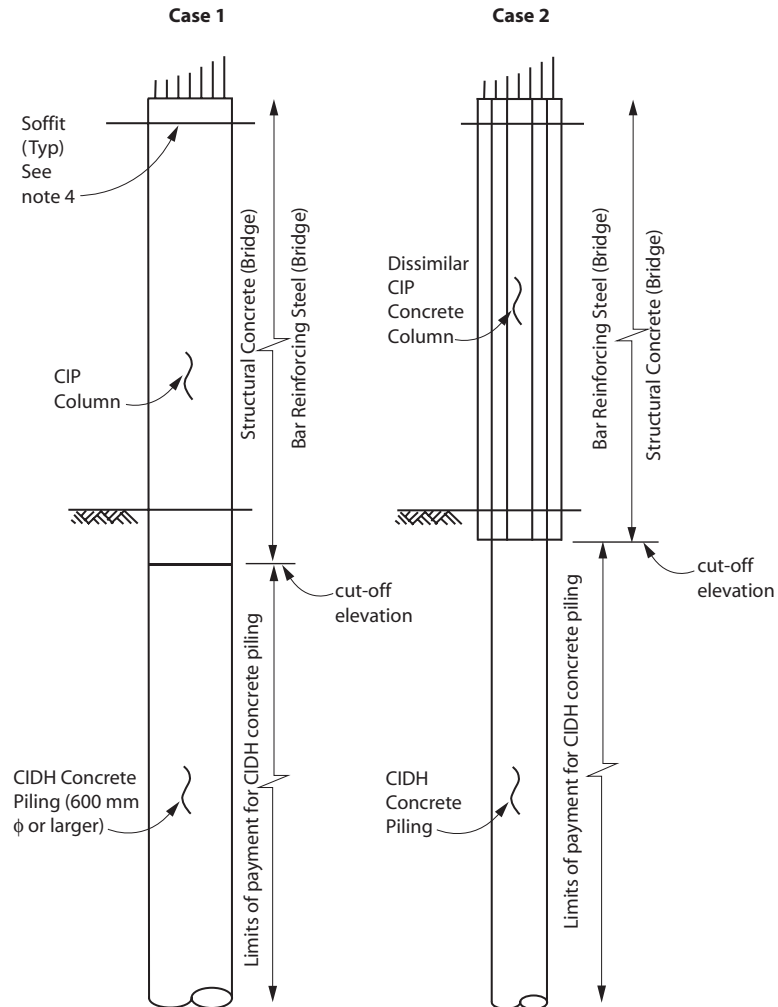


Notes

1. The extension may or may not have the same reinforcing as the pile.
2. Pay limits shown here should also be included on the plans.
3. Calculate pile length to specified tip elevation.
4. Limits of embedment into soffit to be determined by the designer and shown on the plans.
5. CISS Pile Extensions may need to be cleaned and painted.

* Includes CISS concrete piles

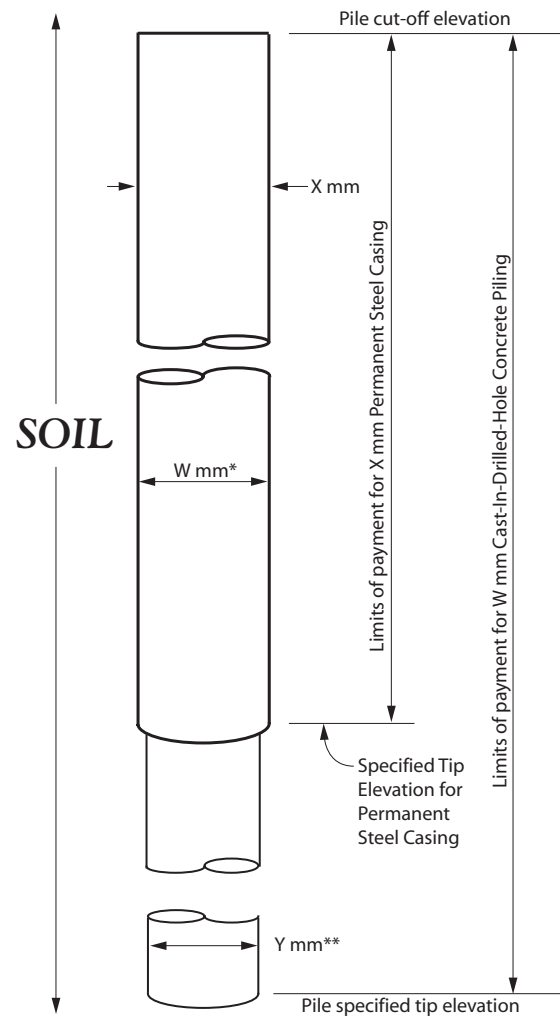
Pile Extensions and Columns for CIDH Concrete Piles



Notes

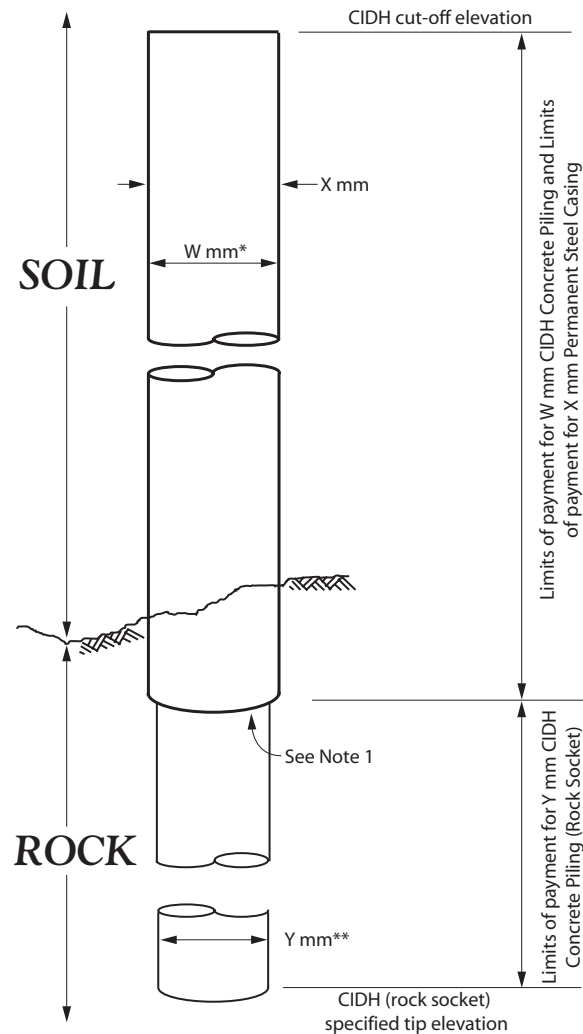
1. The extension may or may not have the same reinforcing as the pile.
2. Pay limits shown here should also be included on the plans.
3. Estimate pile length from cut-off elevation to specified tip elevation.
4. Limits of embedment into soffit to be determined by the designer and shown on the plans.

CIDH Concrete Piling with Permanent Steel Casing (or Shell)



- * Thickness of casing must be shown on the plans.
- * For diameters 1500 mm or less, the diameter of the CIDH concrete piling will be called the same as the outside casing ($W=X$). For diameters greater than 1500 mm, the CIDH concrete piling diameter controls and should be a standard size.
- * CIDH sizes must be a standard size.

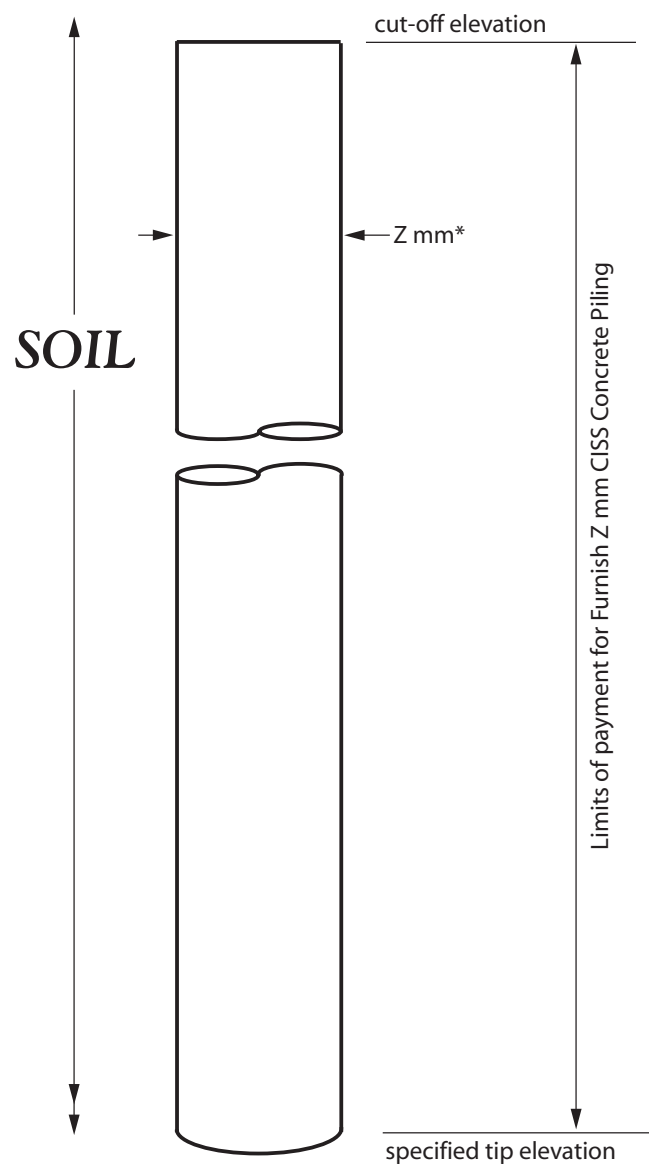
CIDH Concrete Piling with Permanent Steel Casing into Rock



Notes

1. Specified Tip Elevation for Permanent Steel Casing and W mm CIDH concrete piling, and cut-off elevation for Y mm CIDH concrete piling (Rock Socket).
- * For diameters 1500 mm or less, the diameter of the CIDH concrete piling will be called the same as the outside diameter of the casing ($W=X$). For diameter greater than 1500 mm, the CIDH concrete piling diameter is equal to the inside diameter of the casing.
- * CIDH Concrete Piling (Rock Socket) must be a standard diameter.

CISS Concrete Piling



* Thickness and outside diameter should be shown in pile data table (see Memo to Designers 3-1).

Pipes, Conduits, Drains

Bridge Deck Drainage System

1. Paid by the unit kilogram.
2. Include inlets, pipes, supports, etc.
3. Add 3% to mass for galvanized portions.

Miscellaneous Pipes

1. Paid by the unit meter, for each size and type. Indicate thickness for steel pipes, and class for pressure rating for asbestos and PVC pipes.

Sprinkler Control Conduit and Communication Conduit

1. Usually a District Item. Design may be asked to calculate length through structure for transmittal to District.
2. See Standard Plan B14-3.

Supply Line Bridge

1. Estimate by meters for each size. Estimate to 1.5 meters beyond wingwall, see Standard Plan B14-4. The payment per meter of pipe includes hangers, supports, brackets, and expansion details.
2. Do not calculate mass for Access Opening Plates for supply lines, as payment is included in the concrete item.
3. Plan Sheet from the Mechanical Design Branch must be included with Bridge Plans for sizes greater than 100 mm.
4. Estimate casing separately by meter. For limits see Standard Plans (B7-10).

Precast Girders

Furnish Precast Concrete Girders

1. Paid by the unit EACH and separate by nominal lengths and types.
2. List conventionally reinforced and prestressed girders separately.
3. Indicate concrete, bar reinforcing steel, and prestressing quantities for each non-standard girder. Show this information at the bottom of the Marginal Estimate form.
4. For spliced post tensioned girders, calculate prestressing separately in kilograms of steel.

Erect Precast Concrete Girder

1. Paid by the unit EACH for each length.

Prestressing Steel

Prestressing Cast-in-Place Concrete

1. The contract item Prestressing Cast-in-Place Concrete includes placing ducts, prestressing steel, stressing, anchorages, and grouting.
2. Estimate prestressing steel in kilograms, do not include anchorages, ducts, etc. Paid by Lump Sum.
3. Estimate epoxy coated prestressing steel separately. Use strand masses the same for uncoated strands.
4. Mass

$$\frac{P_f \times \text{Length} \times 7,840}{1,074,000} = \text{kg}$$

$$\frac{P_{\text{jack}} \times \text{Length} \times 7,840}{1,396,000} = \text{kg}$$

P_f or P_{jack} in KN
 Length in meters
 For RR loading add 7.5%

Railings and Barriers

Concrete Barriers

1. Calculate quantities of each type separately. Paid by meters. Payment includes the bar reinforcing steel and all bar reinforcing that extends into the barrier. For Types such as 25B, 26A, 732B, 736B earthwork is included.
2. Drill and bond dowels for Type R rail replacement is included in the price per meter of barrier.

Metal Railing

1. These are usually steel railings such as tubular hand railing, chain link railing, or cable railing.
2. Calculate quantities for each type separately in meters. This includes anchor bolts or post pockets.

Temporary Railing

1. Estimate by meters for locations shown on the plans or required for falsework openings. Type K should be in 6.1 meters increments.
2. The total length for payment includes the lengths each time it is used at (or moved to) a new location.
3. Include pay quantity for K-Rail in "Advanced Planning Estimates" only. District will include quantities with District Items at PS&E.

Structural Steel

Furnish Structural Steel (Bridge) and Erect Structural Steel (Bridge)

1. Segregate by type of steel and estimate in kilograms.
2. Include bearings (except PTFE Spherical Bearings), anchor bolts, shear connectors, and expansion dams (except where expansion dams are galvanized or embedded in concrete).
3. Ignore small, non-repetitive cuts, copes, and bolt holes.
4. Add 3% for welds and bolts.



Clean and Paint (Structural Steel, Steel Piling, Sign Structure, etc...)

1. Estimate by kilograms of steel sections to be painted.
2. Paid by Lump Sum.

Walls

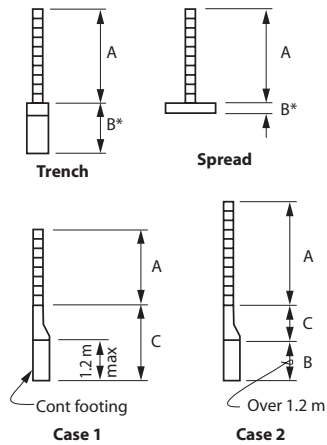
Closure Walls

1. Estimate by square meter.
2. Specify alternative(s) if all three are not allowed.
3. Architectural treatment for closure wall is included in the cost per square meter of wall.

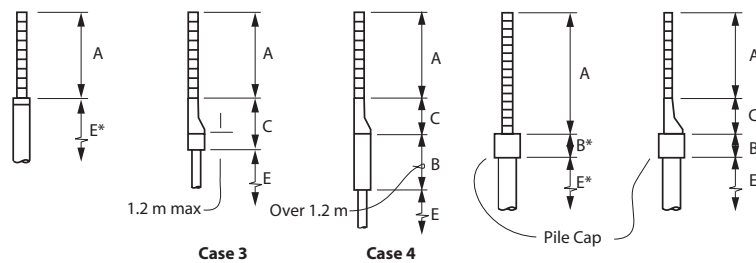
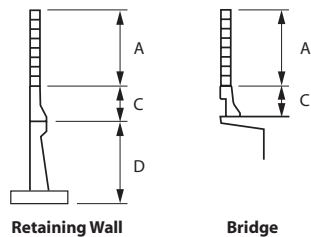
Mechanically Stabilized Earth Walls – MSE

1. Paid by the square meter.
2. Includes excavation, backfill, drainage, and architectural treatment.

Sound Walls



If wall is both Case 1 and 2, use Case 2



If wall is both Case 3 and 4, use Case 4

* These are separate items

**Usual types

TYPICAL SOUND WALL ITEMS

- 400 mm CIDH concrete piling
- Sound wall (Masonry block)
- Minor concrete (Sound wall)
- Concrete barrier (TYPE)

If the sound wall is sitting on a retaining wall or concrete barrier, all the support items are typically paid for separately. If a sound wall is sitting on anything else, everything is included in the square meter price of the sound wall. However, all quantities are needed for cost estimating.

ESTIMATING QUANTITIES

- A. M² of wall, indicate each type.**
- B. M³ of Minor Concrete (Minor Structure), includes excavation, backfill & reinforcing
- C. M of Concrete Barrier (indicate type).
- D. Usual retaining wall quantities.
- E. M of CIDH concrete piling, indicate size.
- F. M of special wall cap if used.

Miscellaneous

Architectural Treatment

1. Estimate by square meter of area for each type to be treated.
2. Architectural treatment for Mechanically Stabilized Earth walls (MSE walls) and closure walls is included in square meter cost of wall.

Asphalt Concrete

1. Estimate by tonne. (2,250 kg per m³)
2. Use Type B for overlays on concrete bridge decks.
3. If the roadwork also has AC (Type B), contact the District Designer to see if they will include the quantity in their estimate. If so, note this on the Marginal Estimate Form.

Asphalt Membrane Waterproofing

1. Estimate by square meter for area delineated on plans.
2. This is for underground use, not for use as a deck seal.

Bridge Removal and Bridge Removal (Portion)

1. Usually paid as a lump sum.
2. Calculate square meter area of deck, and type of bridge, for complete bridge removal.
3. For Bridge Removal (Portion) calculate in cubic meters of concrete to be removed (except for concrete barriers).
4. Unless noted otherwise, removal will be to 0.91 meters below finished grade.
5. Includes excavation and backfill directly associated with removal.
6. Provide As-Built GP sheets for bridge removal.
7. If concrete barrier is to be removed, provide length to be removed.

Column Casing – Steel

1. Calculate quantities in kilograms.
2. Mass (kilograms) per square meter of various thicknesses
 - 9.5 mm = 75.3 kg per m² of column casing
 - 12 mm = 100.1 kg per m² of column casing
 - 16 mm = 125.7 kg per m² of column casing
 - 19 mm = 148.3 kg per m² of column casing
 - 25 mm = 199.5 kg per m² of column casing

Core Concrete

1. Calculate length of hole to be cored in meters for each diameter size core.

Deck Seal

1. Estimate by square meter. Use distance between rails plus 127 mm above finished surface at each rail face. This is for a membrane seal.
2. See also Quantity Take Off for Deck Rehabilitation.
3. Also need item for clean deck, in square meters, on deck rehabilitation projects.

PTFE Bearings

1. Paid by the unit EACH, for concrete structures.
2. Paid by the unit kilograms of structural steel, for steel structures.
3. Multiple discs in a bearing assembly count as a single unit.

Remove Concrete

1. Estimate in cubic meters. Concrete will be removed to a depth of one meter below finished grade unless shown otherwise.
2. See also Structure Excavation.

Rock Slope Protection

1. Usually a District item – check with District Project Engineer.
2. Estimate in cubic meters. Specify size of rock (1/4T, 1/2T, etc), and placement method.
3. Item includes necessary excavation, etc.
4. Does not include fabric required (separate items).

Soil Nails

1. Paid by length in the unit meter.

Tieback Anchors

1. Paid by the unit EACH.

Timber

1. Paid by cubic meter. Use nominal sizes and do not deduct for bevels or daps.
2. Do not estimate hardware such as nails, lag bolts, washers, etc.
3. Estimate structural metal, such as shapes, castings, eyebars, etc., by the kilogram and report separately.
4. Estimate treated and untreated separately.
5. Estimate timber catwalks by meters.

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Cost Estimates Branch

Services provided:

- The ES Cost Estimates Branch provides project cost estimates and construction working day schedules for all phases of project development for highway bridges and transportation related structures. Additionally, the Branch collects, organizes, analyzes and disseminates statistical cost data for bridge construction work.

Documents & Spreadsheets:

[Forms](#)

[Construction Statistics, 2003](#)

[Comparative Bridge Cost 2004 \(English Units\)](#)

[Comparative Bridge Cost 2004 \(Metric Units\)](#)

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